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CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

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CONTENTS

EDITORIAL:
- Michigan Taxes 165
- The New Haven Debentures. 165
- Unique Forces of Railroad Prosperity.... 166
- Is Reciprocal Demurrage Just?..... 166
- Scientific Railroad Operation in Australia 167

ILLUSTRATED:
- A German Motor Car 169
- Electric Operation of the Simplon Tunnel 170
- New Lehigh Valley Bridge over the Susquehanna River, near Towanda, Pa.... 174
- The Railroads of Victoria. 177
- The Atlantic Shore Line Railroad..... 178
- Foot-Power Generator for Controlled Manual Block Station 180
- Locomotive Superheaters. 181

CONTRIBUTIONS:
- The Profitable Weight and Speed of Freight Trains..... 168
- Substitution of Electric Motor for Steam Locomotive 168

MISCELLANEOUS:
- Fuel Tests on the Wheeling & Lake Erie 169
- Legislative Centralization 172
- Safety by Legislation 177
- Interstate Com. Commission Tariff Rulings 178
- Railroad Decisions in January..... 179
- The Early Use of Balanced Slide Valves.. 180
- National Characteristics in Locomotive Building 186
- Foreign Railroad Notes: Japanese Railroads 188

GENERAL NEWS SECTION:
- Notes 189
- Obituary 191
- Meetings and Announcements 191
- Elections and Appointments 191
- Locomotive Building 193
- Car Building. 194
- Railroad Structures 194
- Railroad Construction 195
- Railroad Corporation News 196

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The state of Michigan, judging by an editorial in one of its local papers, is beginning to suspect a fly in the ointment of heavy taxes on railroad gross earnings, under the law which after being bitterly contested by the railroad companies in the courts, was definitely decided last year in favor of the state. This tax is a splendid revenue producer. Under it railroad taxes are greatly increased. This is all very well as far as the state treasury is concerned, but the effect of the heavy tax is being felt in quite another way by the people of the state. There is need for new railroads in certain undeveloped parts of the state, but in spite of the remarkably high prosperity of the last two or three years, no new steam or electric lines are being built nor are existing railroads extending their lines into undeveloped districts. The cause for this standstill in railroad development is clear if the opinions of two railroad officers, quoted in the editorial referred to, can be taken as typical. One of these men is Treasurer of the Grand Rapids, Grand Haven & Muskegon Railway, a third rail electric road with 48 miles of line connecting the cities named in its title, handling both passenger and freight traffic. According to his statement this company has, under the new tax law, paid 8 per cent. of its gross earnings to the state, besides paying local taxes on a assessment of $12,000 a mile in 1905, $8,000 a mile in 1906, and $10,000 a mile in the present year. Under the highest of these assessments, the 33-ft. right of way of the electric road running through a 160-acre farm pays more taxes than are paid on the whole farm, including improvements. These heavy payments are required for the privilege of running a line which is building up the territory through which it runs and increasing the value of all adjoining property. Similar views come from J. D. Hawks, President of the Detroit & Mackinac, who says:

> The electric lines are not the only ones that suffer from excessive taxation. The Detroit & Mackinac pays to the state $80,000 a year for taxes, and all it is paying to its stockholders is $46,000 a year; and for what? For building up and developing a part of Michigan that otherwise would be a wilderness. The stockholders are receiving a little more than half of the amount paid to the state, and yet capitalists are asked to put more money into Michigan railroads so that the state can get the lion's share, while furnishing none of the capital, none of the risk, and none of the nerve necessary for the building and operation of the lines. People will not build railroads nor furnish the money to build them unless the population and the business is in sight, especially in a state where such enterprises are penalized, and you can make up your mind that roads which are being built on paper will not get any farther than the paper plans until a change is made in the policy of the state toward the railroads. We would not object to paying a fair amount of taxes, being taxed for the physical property only, as other taxpayers are, but paying on the so-called intangible values is coming it too strong.

These opinions sum up briefly the effect of the heavy state taxation on the investment of capital in railroads. It is evident that Michigan is feeling the effects of imposing heavy burdens on railroads in much the same way that the states prominent in the Granger legislation of the seventies found that capital would not be provided for the extension and development of railroads overburdened with public restrictions.

Issues of new stock at par by prosperous American railroad corporations and the consequential "rights" of the shareholder are bringing up some novel questions as to both equities and law relating to those rights. Some time ago we called attention to a curious set of such questions raised by the New Haven company when it renewed the convertibility of the balance outstanding of a large issue of debentures some years after convertibility had expired. The same company has now brought up another interesting point. It has outstanding $30,000,000 of debentures convertible into stock some four years hence in the ratio of $150 in debentures to one share (par $100) of stock; and the company plans a large issue of stock within a few months. It has a bill before the Connecticut legislature allowing the debentures to come in for the new stock and stock rights on the basis of the two-thirds privilege. So far all is clear enough, though it is to be noted that the company must appeal in the matter for special legislation and apparently has not the "debenture" powers under charter or general statute. But on some $12,000,000 of the convertible debentures only 50 per cent. has been paid in, and the new issue of stock will find them only partly paid. Hence arise such queries as these: In regard to the new stock and its "rights" shall the debenture holder who has paid up 50 or 75 per cent. be equalized with the holder who has paid up in full? Ought the company, after issuing the debentures under certain terms as to payment of installments, by restricting the new stock to "full" payers use a kind of a fiscal club to compel full

payments?—which, by the way, would for a short time secure some millions at a low interest rate. And, finally, has a railroad corporation a right, legally speaking, to give stock rights to a promise to pay? Special legislation may answer the last question affirmatively, but how would it be answered in the absence of such legislation? The foregoing is only one of many novel phases of the status, forms, methods and times of issue, and questions of equity, law and expediency, raised and to be raised by the present striking period of high rate railroad borrowing, when by dividend paying corporations, earning fixed charges several times over, are well nigh at their wits' end in devising expedients to reduce the interest rate. For some years to come it is highly probable that corporations with outstanding convertibles will issue new stock with rights. How will they deal with the convertible bond holder who is a stock holder *in futuro*. Will they recognize him or will they ignore him, and if they recognize him, to what extent?

UNIQUE FORCES OF RAILROAD PROSPERITY.

In some important respects the present railroad period stands unique in the annals of American transportation by rail. We have had, relatively and absolutely, more active periods of new railroad construction. We have had times when in certain regions or on certain trunk lines, owing to local and temporary causes, there has been a heavy surplusage of traffic resting on the affected companies; and we have had, in years comparatively recent, periods when the market value of not a few railroad stocks has reached a higher level than now. But never before in the history of railroads in this or any other land has there been such a tense and universal pressure of railroad traffic on railroad facilities; when new tracks, new yards, new passenger terminals and new cars, especially the latter, have been so craved; when the call for extensive railroad betterments has been so imperative and has had to interpret itself in new financing, not only on a vast scale but in high interest rates paid to secure the needed funds. Some phenomena, on their face paradoxical, such as the apparently depressing influence on stocks of rights and of increased dividends may be passed by. They are, in fact, not so irrational as they seem, but rather the logical consequence of the higher law of supply and demand superseding for a time the law of intrinsic values. It is more instructive to refer to some of the remoter forces which bear upon the present era of railroad prosperity—forces not less important because a number of them promise to be permanent.

The first of these forces may be called a local one, though it is hardly just to apply such an adjective to an immense section of the Union. We refer to the great natural development of the country and of railroad business and enterprise on the Western periphery of our national railroad system—in that great region represented by the far West, the Northwest and, to a slightly less degree, the Southwest, and covered in the main by the Harriman, Hill and Santa Fe systems. The reorganization of the Union and Central Pacific roads eight years ago was a kind of starting point of this far Western railroad prosperity. President Mellen, after coming to the New Haven, emphasized this upward movement when, in one of his talks, he spoke of the contrast between the development of his former Northern Pacific line and that of an Eastern road—the small new station on the Northern Pacific growing quickly to a village and large business point in contrast with the lack of new separate points of railroad traffic in the densely populated railroad territory of southern New England. When the historian of railroad affairs in years to come analyzes our present epoch of railroad uplift he will hardly fail to rank among its leading components, both in time and strength, this far Western initiative resting on new material development with immigration as its backbone. Conspicuous in itself, as it has been and is, it has hardly been given its due place as a factor in the existing railroad situation.

Two other forces may be bracketed together, namely, the readjustment of labor so as to be more efficient and the enormous expansion of special industries. The beginnings of real prosperity which may be roughly dated about seven years ago, found not only a considerable group of the unemployed workingmen but others employed in a desultory and temporary fashion. The high demand for labor, which to these has supplied steady work, has had, to be sure, to encounter many obstacles—strikes, shorter nominal hours, closer organization of the unions, demands often dictatorial and much higher wages. But the obstacles appear to have been more than offset by two agencies of added production—quicker labor in piecework, stimulated by better pay and the employer's demand for overtime; and the better industrial organization that characterizes a period of high production. Add to these the expansion of special products such as structural steel and, more noteworthy, the enormous demand for raw and manufactured copper, stimulated by electrical invention and its new utilities, all of them bearing positively on railroad business, and one finds other unique elements of railroad prosperity or at least unique in that earlier periods have had them in much lesser degree.

To the foregoing, as an influence in the present railroad status, is to be added another, unique for our times—the telephone. Its great increase, its multiplied uses, its established place as an instrument of first necessity in business and household are attested by the returns of the telephone companies and by everyday experience. In a commercial sense and in actual practice the telephone is not exactly a labor saver. Men work as hard or harder than they did before they had it. But with the wonderful device men become much greater producers. In its relation to the railroads, the invention has had a two-fold bearing. Its long distance operation has undoubtedly cut off some of the passenger traffic which the roads would otherwise have gained. But they have gained passengers nevertheless; and in its relation to freight traffic the telephone has been the same stimulant that it has been in general commerce and a powerful agency of production not to be rated lower because its results cannot be reduced to figures. Indeed, remembering that any stimulus to production is also a stimulus of travel, it is doubtful whether the direct effect negatively of the telephone or passenger traffic is as great as its indirect and positive effects as a promoter of that branch of railroad business.

Reviewing all the foregoing elements in our railroad situation, one finds that most of them are in their intrinsic nature permanent. Industrial depression will affect seriously labor and such branches as structural steel; much less electrical industry; and the growth of the West and the productive power of new invention, including the telephone, hardly at all. We must reckon up all such co-efficients and strike the balance in any estimate—apart from Wall street—of the endurance of the present remarkable epoch of railroad business.

IS RECIPROCAL DEMURRAGE JUST?

Under the old competitive conditions there grew up the abuse of delaying cars in loading and unloading far beyond the time necessary for these operations. Cars were used for storehouses or ordered when not immediately needed to such an extent that terminals were badly congested, the roads were short of cars and were suffering great losses as a result. More than this, the conscientious shipper or consignee, who handled his cars promptly, had to suffer from the slow movement and car shortages which resulted from the dilatory methods of his less scrupulous competitors. A few years ago the railroads put in force a "demurrage rule" under which, after a reasonable time allowed for loading or unloading a car, a charge of $1.00 a day thereafter is made for detention of the car. This charge does not cover the loss which a railroad suffers by delays to its cars, as a moving car is generally worth many times one earning only $1.00 a day, but it served to do away with the worst abuses of the old system. This charge made by the carrier is really not a penalty but a rental paid by the shipper for the use of the railroad's property while in his possession after a reasonable time for loading or unloading has passed. It has been sustained by the courts as a legitimate, reasonable and constitutional charge and a public benefit in that it results in quicker car movement and a larger available car supply. Without the demurrage rule the unusual car shortages of the last two years would have been far worse. It is easy to conceive that during the extreme conditions of the past few months the commerce of the country might have been absolutely paralyzed if all consignees or shippers had been at liberty to hold cars as long as suited their individual convenience.

As a direct result, however, of the recent car shortage, the idea has been suggested that there should be an arrangement by which, just as shippers are penalized for delay in handling their cars, the railroads should be penalized for failure to furnish cars promptly when ordered by the shipper. This is called reciprocal demurrage. It sounds like a fair arrangement at first, but it is not. One vital objection to such a rule is that a large shipper, who could often hold or forward his shipments equally well, would be in a position

to wait until the railroad which served his plant was particularly short of cars and then demand a large number of cars, knowing full well that they could not be supplied. He would then, under such a rule, be able to collect from the railroad a sum which would represent no service of any sort rendered by him to the railroad, but which would in effect be a rebate on his past or future shipments. Again no rule can compel a railroad to furnish cars for traffic destined for points off its line. Under a reciprocal demurrage law all shipments would be transferred from car to car at junction points in order that each railroad might keep its own cars at home to protect itself in case of demands for cars. This would be a distinct backward step in the art of transportation. It would naturally result in great delays to traffic and increased charges for transportation. Reciprocal demurrage, if carried into effect as now proposed, would not in any way directly help to expedite the handling of traffic but would, on the contrary, hinder it.

Some states have enacted a reciprocal demurrage law. In each case the railroads have promptly protested and, so far as is known, the law has come to be a dead letter. It is hardly fair to call such a law "reciprocal." Reciprocity implies a return of like for like, yet this law would impose a charge for something which may have no existence, whereas the cars for which the railroads charge demurrage to shippers are actual pieces of railroad property in the hands of others. For this reason the fundamental principle of the law is believed to be unconstitutional. The shipper offers no property and, therefore, is not entitled to any compensation. If he is unable to obtain cars, the redress open to him is an action for damages, which is a distinct and separate issue. This is a question which has been decided by state and federal courts and by the Interstate Commerce Commission, which rule that it is the duty of the railroad to provide reasonable facilities for handling the traffic offered to it. Not even a railroad can be constitutionally required to perform an impossibility, and when a flood of traffic, such as that of the fall months of 1906, comes, surpassing all reasonable estimates, the carrier cannot be held to have failed in its duty if it has supplied without discrimination such facilities as, after reasonable increases in its rolling stock, it has at hand. To penalize the railroads under a reciprocal demurrage law would be to take away its property without due process of law and would be, therefore, unconstitutional. Unconstitutional or not, the reciprocal demurrage law proposed would compel railroads to make large investments in equipment which, during two-thirds of the year, would be lying idle on side tracks where depreciation is as fast or faster than in active service.

Yet there is no doubt that there can be an improvement in present car service conditions. Reciprocal demurrage will not solve the present problems. What will solve them is a hearty co-operation between railroads and shippers, the former providing ample facilities and expediting its traffic, the latter making provision for properly handling their business and using reasonable despatch in loading and unloading their traffic. Shippers and consignees can do more to relieve the extreme conditions of car shortage which have prevailed during the past two months than any other one class. The railroads are doing their best; the equipment companies are doing theirs. To lay all the blame on the railroads for the present congestion of traffic is highly unjust. It is the prosperity of the country which is to blame. Railroads have spent great sums in improving their facilities, but the tremendous rush of traffic which has come to them could not have been foreseen as a probability, much less as a certainty. The shipper is extravagant in the use of transportation facilities. From 30 to 60 per cent. only of the country's car capacity is now fully employed; this as a result of business customs in ordering, packing and loading which, if reformed, would increase the car supply by an amount large enough to do away with car shortages, as such, even in times like the present.

SCIENTIFIC RAILROAD OPERATION IN AUSTRALIA.

On July 1, 1903, Mr. Thomas Tait began his work as Chairman of the Commissioners of Railways of the colony of Victoria, Australia. Mr. Tait had had a thorough training in American railroad methods. He resigned the position of Manager of Transportation of the whole Canadian Pacific railroad system, which he had reached after some 23 years of railroad service, beginning as a clerk in the accounting department of the Grand Trunk at Montreal, and including a large amount of experience in the operating department of the Canadian Pacific. Victoria occupies the southernmost part of Australia and is bounded on the north by New South Wales and on the east by South Australia. Melbourne is the principal city. The railroads are owned by the colonial government and, as shown on the map in another column, radiate from Melbourne, about which centers an extensive suburban system. Railroad development in Victoria has been much like that in the western part of the United States. Lines have in general been laid out to create traffic rather than to take care of existing business, and in many cases the country has not yet grown up to its railroad facilities. The lines are mostly single track and depend for their best traffic on agricultural products, particularly wheat. The average mileage worked is 3,394 miles, of which 82 miles is 2½-ft. gage and the rest 5¼-ft. gage. In the year ended June 30, 1903, the year immediately preceding the present administration, there was a deficit after charges from the operation of the Victorian Railroads of about $1,800,000, following a deficit of nearly $1,000,000 in the year ended June 30, 1902, when gross earnings were the largest under the previous administration. The Victorian government, alarmed at the rising deficit, decided to see what could be done under American methods, and Mr. Tait was appointed Chairman of the Railway Commissioners. He is the actual working head of the roads, reporting to the Minister of Railways. The other two commissioners are working departmental officers, whose combined authority can at any time be overruled by the Chairman, so that the new American officer was given authority commensurate with his responsibility. Besides the actual difficulties of reorganization and management which he had to meet, there were accumulated extraordinary liabilities of $3,850,000 made up of belated repairs, deficiency in rolling stock, overvaluation of stores and loan funds advanced for works which should have been paid for out of revenue.

At the end of the first year under Mr. Tait's administration, ended June 30, 1904, the Victorian Railroads, for the first time in 15 years, showed a surplus over all charges—a small one to be sure, only $2,500, but enough to show a healthy change in the condition of the roads. Results since that time have been what the Melbourne *Argus*, reviewing the report for the year ended June 30, 1906, calls "a story of almost romantic success." Gross earnings have increased from $14,800,000 in 1903 to $18,400,000 in 1906, and net earnings from $5,900,000 to $8,700,000. Against a deficit after charges of $1,700,000 in 1903 the past year shows a surplus of $968,960. Taking the year ended June 30, 1902, the most prosperous year under previous administrations, as a fairer standard of comparison, there is still a noteworthy series of increases. Gross earnings in 1906 increased more than $2,000,000 over 1902 and net earnings nearly $2,300,000. The 1906 surplus is almost exactly the same as the 1902 deficit. It must be remembered also that the surpluses of the years 1904, 1905 and 1906, under Mr. Tait's administration, have been obtained after providing for a large part of the extraordinary liabilities already referred to. On July 1, 1906, the unpaid balance of these deferred payments, instead of amounting to $3,850,000, was about $950,000. Not quite $3,000,000 has been appropriated out of earnings during the last three years for this purpose. This is a record of achievement of which Mr. Tait and America for him may be proud. It is pleasing to see that it is also appreciated in Australia.

These are the general financial results. The detailed unit figures of operation show the same success just as concretely. In 1902 and 1903 the gross earnings per traffic train-mile were about $1.44; in 1906 they were $1.95, an increase of 51 cents. In this same time, operating expenses per train mile increased about 15 cents, leaving net earnings per train mile 92 cents in 1906 against 56 cents in the two earlier years, an increase in net earnings for each mile run of 35 cents, or over 60 per cent. in this vital unit of operating profit. The net earnings per traffic train mile in 1906 were the largest in 26 years. The operating ratio meanwhile has decreased from 60 per cent. to 53 per cent. That maintenance expenses have not been skimped to bring about a reduction of this working ratio is proved by the cost of maintenance of way per mile of road which, in 1903, was under $600 a mile and in 1906 about $750 a mile.

Considerable reductions in freight rates were made during the year amounting to from 8 to 16 per cent. for different classes, and also including new and lower classifications. The Commissioners strongly recommend a plan for application of the surplus revenue which, in their judgment, will make it practicable to further gradually reduce rates as may appear to be advisable for development of production and trade. This recommendation is to the effect that surplus revenue after all charges shall be devoted, first, to liquidating the remaining $950,000 of extraordinary liabilities; second, for additions and improvements, including rolling stock, thus obviat-

ing the borrowing of additional money by the state for such purposes, and, third, to building up a revenue reserve fund, so that when by reason of unfavorable seasons or other causes the net revenue of the roads is not sufficient to pay in full the interest charges on the railroad debt of the state, the deficiency may be made good out of this reserve fund. These recommendations are aimed at carrying out the ideal conditions of government owned railroads, that is, to furnish the best possible service at the least practicable cost without either bringing high returns to the state on its investment or becoming a charge on the general revenue.

The record of Mr. Tait as manager of this 3,000-mile system of government railroads, long inefficiently managed, is a striking example of the success of scientific railroad methods. It is of more than ordinary interest to American railroad men at present, because a similar position in the neighboring colony of New South Wales is now vacant. The New South Wales railroads are to be managed by Commissioners with powers similar to those of the Victorian Commissioners, and the government of that colony is advertising for a man who can follow Mr. Tait's example in Victoria.

CONTRIBUTIONS

The Profitable Weight and Speed of Freight Trains.

Baltimore, Md., Jan. 29, 1907.

To the Editor of the Railroad Gazette:

The recent trouble arising from car shortage has induced many inquiries as to the seat of the trouble, and the statement has been made in several quarters, notably by Interstate Commerce Commissioner Lane, that the railroads have aggravated the shortage by an alleged practice of holding freight until a big train load can be secured and by giving it slow movement after it has once been started on its way.

It is probably open to question whether much actual delay has occurred in yards from holding cars for big train loads, but there is considerable room for discussion whether the big train load is proving as profitable as it is undeniably shown to be when consideration is given to the simple fact that many cars handled behind a large engine is a more profitable operation than a few cars handled behind a smaller engine. It so happens that this is not a fact, or at best is a dangerous half-truth on railroads of sufficient density of traffic to require the continuous movement of freight trains between any two points or when it is applied to the relief of yard congestion; and it is so because one of the most important elements of profit in railroad operation is speed of movement, for the main reason that a large proportion of a railroad company's expenses are fixed in amount regardless of the quantity of freight and passengers moved, and for the secondary reason that slow speed implies great weight, a consumption of fuel and stores disproportioned to the gain in weight and seriously rapid wear and tear and depreciation of implements.

Under conditions of traffic scarcity where a train can pursue the even tenor of its ways, disturbing nothing and by nothing disturbed, and with no cars waiting for movement—under such conditions the governing law for profitable movement may be said to be the avoidance of overtime, but even here the law should not be accepted without certain reservations in respect to wear and tear to equipment, especially the locomotive. But when it is a case of traffic waiting movement and numerous trains in movement, all treading on each other's heels, then indeed the simple idea of the big load becomes the compound idea of the big load plus movement.

I have prepared and send you herewith a table arranged to show the net earnings after the payment of certain expenses from the continuous operation through 5,000 hours of trains of various numbers of cars at various practicable speeds. This table requires for acceptance the admission of the following premises:

(a) That the increases in speed as shown in line B can be secured from the decreases in cars per train, or per train-mile as shown in line C.

(b) That the decreases in cost as per line H, are properly proportioned to the decrease in cars per train or per train-mile, as per line C.

If these premises are approximately correct, the conclusion is inevitable that there is more net money in speeds of 15, 20 and 25 miles per hour than in speeds above or below these rates.

It appears to be generally accepted that a reduction of 10 per cent. in a heavy load which permits a movement at about 10 miles an hour will immediately produce a possible increase of 50 per cent. in speed; that if the load be cut 30 per cent. the speed can be doubled, etc. As it may be questioned whether a 10 per cent. reduction in load (the table makes the reduction 12½ per cent.) will admit of an increase of 50 per cent. in the speed, the last column in the table gives a reduction of 30 per cent. in the load for an increase of 50 per cent. in the speed, and still it will be observed that after this heavy cut in the load the net revenue is much larger than at the speed of 10 miles an hour. The misfortune is, however, that it is questionable whether it is safe to run such heavily-weighted cars at the speeds requisite to give the inclusive speeds indicated as the most profitable. If the reduction in the weight of train were made partly in cars and partly in load in cars the relative showing in line E, would not be affected, as the earning per loaded car-mile there shown is a general average covering all cars.

The costs included in line H, cover wages of enginemen, firemen and train crews, fuel, train supplies, enginehousemen, operation of fuel and water stations and stores for locomotives; also cost of maintenance and repairs of equipment. These are the expenses which are generally considered to have been most favorably affected by the big train load. They are also the expenses that for the most part are directly attributable to the train mileage and vary most directly with the train mileage. The present cost of the stated items appears to run somewhere in the neighborhood of 75 cents per train-mile. In making this table, reduction in cost has been made chiefly to take account of the reduction in car mileage per train-mile (8 mills per car-mile), but there is no doubt that the quickening of the movement would be attended with decreased consumption of fuel per train-mile and material decreases in wear and tear. Hence, I do not believe the reductions of expense per mile made in the table will be found exaggerated. I submit this table and invite the severest criticism of it in the hope of advancing the cause of truth and ascertaining really what is sound in the mass of theories relative to railroad operation that afflict us in the present day. We certainly do know that Germany has had the problem of the heavy train load before it, and has decided adversely to it; and we also know that English train loads have been and are likely to continue to be feather-weights in comparison with our own. Meantime we are laboring along under the exceeding difficulty of keeping up the car supply and taking care of bills for depreciation which are little short of appalling.

Under the influence of recent congressional legislation it is becoming more than ever necessary that the railroads should get more train mileage for the wages paid the train crews. It should, therefore, be gratifying if it is found that the accompanying table approximates the truth.

M. B. WILD,
Statistician, Baltimore & Ohio Railroad.

Statement Comparing Net Revenue Derivable from Various Train-Loads, Run at Various Speeds Thoughout 5,000 Hours.

A Required accomplishment of loaded car-miles	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000
B Miles per hour, inclusive of delays	10	15	20	25	30	35	15
C Cars per train, or per train-mile	40	35	28	24	20	15	28
D Number of train-miles, A ÷ C	50,000	57,143	71,429	83,333	100,000	133,333	71,429
E Value of train-mile at 10 cts. per loaded car-mile	$4.00	$3.50	$2.80	$2.40	$2.00	$1.50	$2.80
F Gross revenue	$200,000	$200,000	$200,000	$200,000	$200,000	$200,000	$200,000
G Number of hours in which accumulated D ÷ B	5,000	3,810	3,571	3,333	3,333	3,810	3,810
H Cost per train-mile for train expense, roundhouse expense, and M. of E.	$0.75	$0.71	$0.66	$0.62	$0.59	$0.55	$0.66
I Total cost for train expense, roundhouse expense and M. of E., H x D	$37,500	$40,572	$47,143	$51,666	$59,000	$73,333	$47,143
J Net revenue	$162,500	$159,428	$152,857	$148,334	$141,000	$126,667	$152,857
K Hours gained over longest period in line G	.....	1,190	1,429	1,667	1,667	1,190	1,190
L Train mileage run in hours gained, B x K	.....	17,850	28,580	41,675	41,675	41,650	17,850
M Revenue from train mileage run in hours gained, L x E	.....	$62,475	$80,024	$100,020	$83,350	$62,475	$49,980
N Cost of train mileage run in hours gained, L x H	.....	$12,674	$18,863	$25,839	$24,588	$22,908	$11,781
O Net revenue from train mileage run in hours gained	.....	$49,801	$61,161	$74,181	$58,762	$39,567	$38,199
P Total net revenue of each train in 5,000 hours	$162,500	$209,229	$214,018	$222,515	$199,762	$166,234	$191,056

Substitution of Electric Motor for Steam Locomotive.

New York City, Feb. 2, 1907.

To the Editor of the Railroad Gazette:

Referring to the brief report of discussions on the Stillwell-Putnam paper in your issue of February 1st, permit me to correct a statement concerning my own part in that discussion which, as it stands, puts me in a somewhat false position.

I did not make the general statement: "Direct-current at 1,200 or 1,500 volts transmitted through a third rail would give better results in every way than high potential alternating current, using the overhead system." What I did say was that on many of the roads which could properly consider electrification at the present

time, as typified, for example, by the New York & Philadelphia division of the Pennsylvania Railroad, the high potential direct-current motor equipment would be more satisfactory, and would give better results than those indicated by any present development of the alternating-current motor and an overhead installation.

FRANK J. SPRAGUE.

Fuel Tests on the Wheeling & Lake Erie.

A number of comparative tests were recently made on the Wheeling & Lake Erie to determine the economy of using three-quarter lump coal as against run of mine coal. The three-quarter lump coal costs at the mine about 8 per cent. more than run of mine coal, and the tests were made to determine whether the higher priced fuel gave a corresponding gain in ton-miles per pound burned. The coal of both grades is bituminous steam coal obtained from the same mine in the southeastern Ohio fields from what is known as the No. 8 Pittsburg seam. Great care was taken that the quality of the fuel should be as uniform as possible at all times during the tests. It was fresh mined and the lump coal carried only about 5 per cent. of slack while the run of mine carried about 15 per cent.

The tests were made in freight service between Nov. 21 and Dec. 21, 1906, on the line from Columbia yard to Ironville, Ohio, 133 miles. Five runs were made for each grade of coal, the same locomotive being used in all tests but with the grates changed to get the best results from each grade. Measurements of water evaporated were made by water glasses and graduated scales and the coal weights given are scale weights taken at Ironville, Norwalk and Columbia. The following table is a summary of the tests made:

Kind of coal	¾-in. coal.	Run of mine.
Location of tests	Ironville-Columbia.	Ironville-Columbia.
Date of tests	Nov. 21-Dec. 2, 1906.	Dec. 13 to 21, 1906.
Total time of tests	69 hrs. 10 mins.	83 hrs. 35 mins.
Average length of test—westbound	10 " 25 "	13 " 48 "
" length of test—eastbound	19 " 28 "	18 " 40 "
" time on road—eastbound	18 " 5 "	17 " 23 "
" time on road—westbound	9 " 49 "	13 " 30 "
Actual running time—eastbound	7 " 45 "	6 " 23 "
Actual running time—westbound	7 " 00 "	7 " 36 "
Time lost during test, standing	31 " 16 "	43 " 31 "
Mean running speed, bet. terminals	18.51 miles per hr.	18.64 miles per hr.
Total number of stops made	52	75
Maximum steam pressure (gage)	200 lbs.	200 lbs.
Minimum " " "	160 "	170 "
Average " " "	187.5 "	186 "
Mean temperature—feed water	48.6°	41°
Gallons water evaporated	101,185	114,539
Pounds of water evaporated	843,208	954,492
Pounds coal burned	128,800	138,700
Money value of coal burned	$68.26	$66.57
Pounds water evaporated per lb. coal	6.54	6.88
Equivalent evap., from and at 212°	7.848	8.31
Lbs. coal brnd per sq.ft. grate area,hr	60.61	55.65
Engine miles run per ton of coal	10.51	9.57
Engine mls. run per 1,000 gals water	9.59	5.79
Average No. loaded cars in train	33.1	30.5
" " empty cars in train	3.4	4.6
" " cars in train	36.5	35.1
" weight of train, tons reportd	1,405.4	1,365.2
" weight of train, tons actual	1,387.6	1,327.7
Distance run, miles	664.0	664.0
Total ton-miles	914,012	881,615
Ton-miles per lb. of coal	7.366	6.356
Ton-miles per gallon of water	9.498	7.68

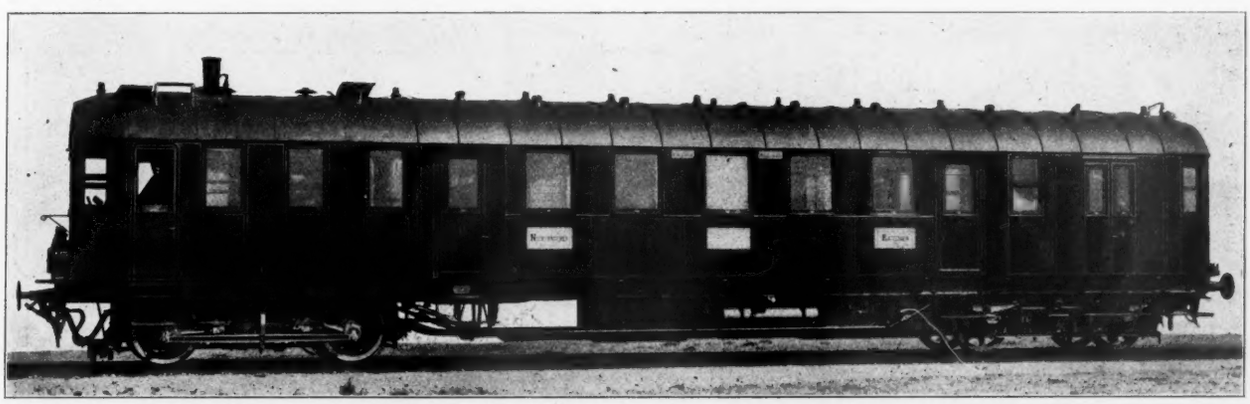
The striking feature of the tests is that the gain in ton-miles per pound of coal in using three-quarter coal amounted to 15.9 per cent., and the gain in ton-miles per gallon of water in favor of the three-quarter coal, was 23.6 per cent. Therefore notwithstanding the saving of 8 per cent. in the first cost of coal at the mines, the gain in ton-miles per pound of coal is considerably in excess of the saving in the price per ton. Furthermore, if the road were to change to run of mine coal it would necessitate the changing of the grates in the locomotives, which would cost $33.90 net per engine.

We are indebted to Mr. B. A. Worthington, Vice-President and General Manager of the Wheeling & Lake Erie for the above data.

A German Motor Car.

The Bavarian State Railroads have recently put in service the steam motor car illustrated herewith. The engine is carried on a bogie independent of the carriage frame. The principal peculiarity of the car is to be found in the cylinders and their arrangement. There is one cylinder upon each side, and in each of these there are two pistons working in opposite directions and driving the front and rear axles of the motor truck, respectively. The ostensible object of this method of working is to eliminate the perturbations due to the unbalanced thrust of the reciprocating parts. By this means a four-cylinder engine is obtained, together with a virtual balance, as the cranks are on all four quarters, those on each side being set opposite each other, and at right angles to those on the other side. Owing to this arrangement and to the limited wheel-base, the connecting rods are very short, being only 26½ in. long, with a piston stroke of 10¼ in. This ratio of 2.58 to 1 between the connecting rod length and the stroke makes the angle at the point of maximum turning moment rather sharp, and when added to the fact that the pistons are moving in opposite directions and driving axles that are coupled together, it brings it about that there is a difference of 23 deg. between the points of maximum crank effort of the two cranks that are driven from the same cylinder. Then, as the velocities and location of the two pistons are different for every point of the stroke except at the centers, it also follows that the point of cut-off differs for the two pistons and with it the amounts of power developed.

The Walschaert valve gear driving piston valves is used, and this is operated by a single eccentric instead of the usual return crank. The lap and lead lever, which is usually driven by a connector from the cross-head arm, is, in this case, operated from a link attached directly to the center of the crosshead.



Steam Motor Car for the Bavarian State Railroads.

The connecting rods are made with forked ends and take hold of the crankpin close to the wheels. Side rods are placed on pins outside the connecting rods, and it will be seen that, owing to the fact that the main crankpins approach and recede from each other, it is impossible to put the side rods on the main pins. They are, therefore, put on return cranks, whose centers are 90 deg. from each of the main crankpins, thus dividing the distance between the two, which, in the matter of rotation is 180 deg. It is on one of these return cranks that the eccentric is placed.

The boiler is of the locomotive type and is fitted with a superheater. At the back end of the firebox there is a bunker set above the door opening, from which the coal falls down upon the fire, the rate of feed being regulated by suitable traps, and peep holes are placed in the firedoors, through which the condition of the fire may be observed.

The car is worked by one man, the driver always remaining with the engine, no compartment being provided for him at the other end of the car. The car can seat 55 passengers and accommodate 35 standing in addition.

The tractive power is put down at 3,590 lbs. and the hauling capacity is equivalent to moving two supplementary cars, each with the same seating capacity as the motor car itself, at a speed of 40 miles per hour. The engines are capable of developing 350 h.p. as a maximum and driving the car at 47 miles per hour on a level. When running under these conditions, the coal consumption varies from 17 to 21 lbs. per mile, that used being of the comparatively inferior character obtained in the north of Germany. A plan of the car would show it divided into four compartments. Two of these are for passengers, one for smokers and one for those who wish to avoid these conditions. Both are for third class travelers. A third compartment is for baggage and parcels, and the fourth, which is at the front, is for the boiler and engineman. The boiler is set back of the foot-plate, at the front of which are the usual

levers and gages used in the control of the machine. The principal dimensions of the car and engine are:

Engine.

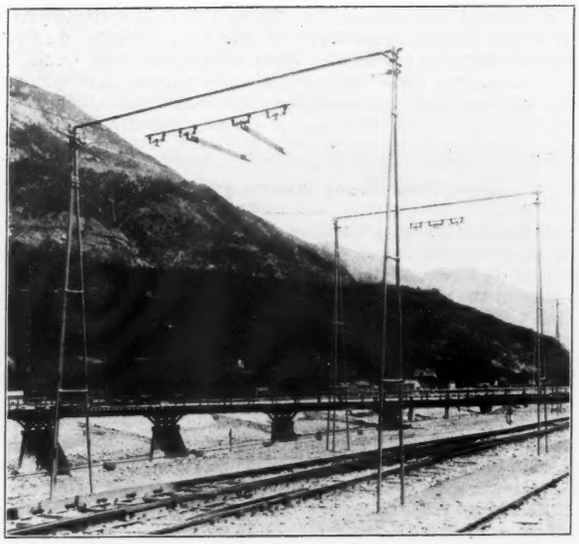
Working pressure	235 lbs.
Cylinders, diameter	8 in.
Cylinders, piston stroke	2 x 10¼ in.
Driving wheels, diameter	39 "
Tractive power	3,590 lbs.
Grate area	9.3 sq. ft.
Heating surface (inside): Firebox	37.3 sq. ft.
" " tubes	405.6 "
" " Total	442.9 "
Superheater surface (fire contact)	74.8 "
Aggregate surface	517.7 "
Engine, weight, empty	35,840 lbs.
Engine, weight, loaded	40,320 "
Tank capacity	880 gals.

Car.

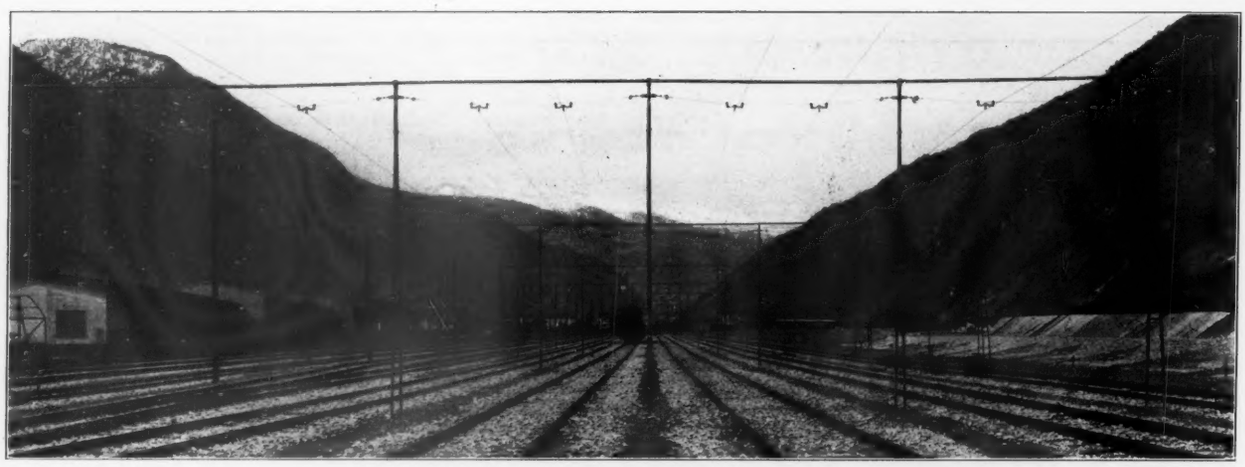
Wheel diameter	39 in.
Wheel base (motor bogie)	9 ft. ¾ in.
Wheel base (coach)	8 " 2 "
Total wheel base	51 " 6 "
Minimum curve radius	600 ft.
Total length of car	78 ft. 7 in.
Greatest breadth	9 " 6 "
Greatest height	14 " 9 "
Motor car weight, empty	100,800 lbs.
Motor car weight in working order	114,240 "
Trailing car, weight	88,480 "
Space for baggage	39 sq. ft.

Electric Operation of the Simplon Tunnel.

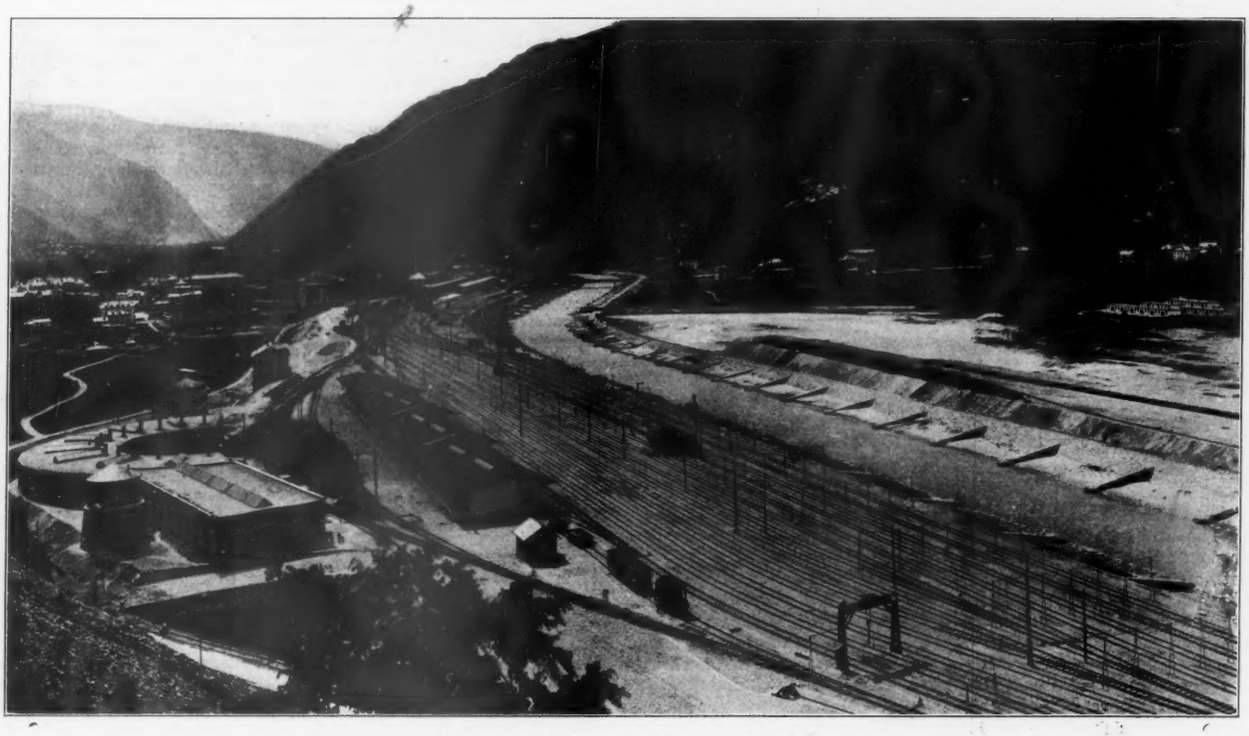
The Simplon tunnel is a double-track tunnel, 12 miles long, between Brigue on the Swiss side of the Alps and Iselle on the Italian side, these two towns being each a short distance from the tunnel



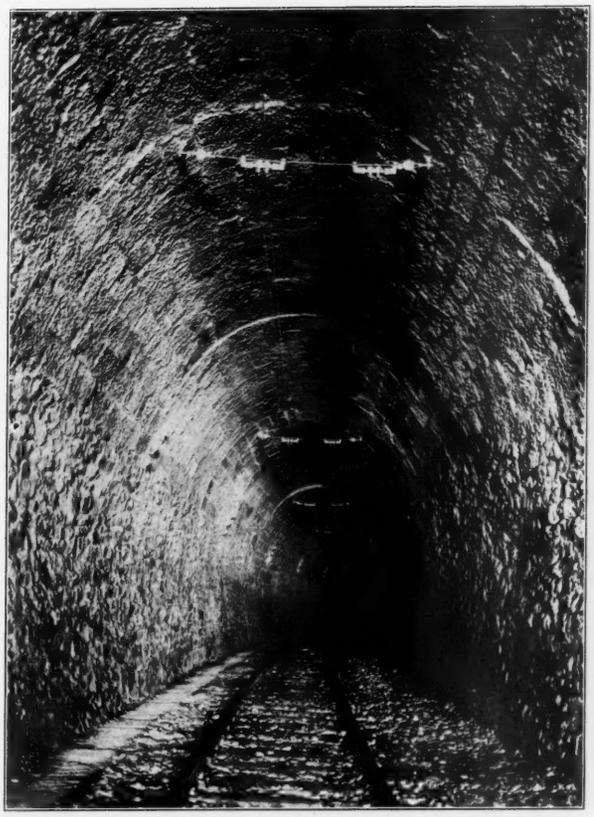
Suspension of Overhead Conductor at Switch.



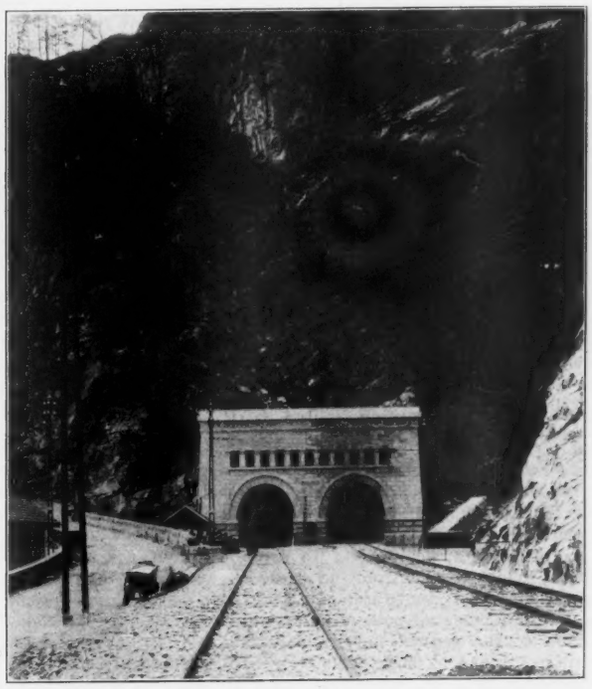
Overhead Construction Spanning Six Tracks Near Brigue Portal of the Simplon Tunnel



Yard and Station at Brigue, Switzerland.

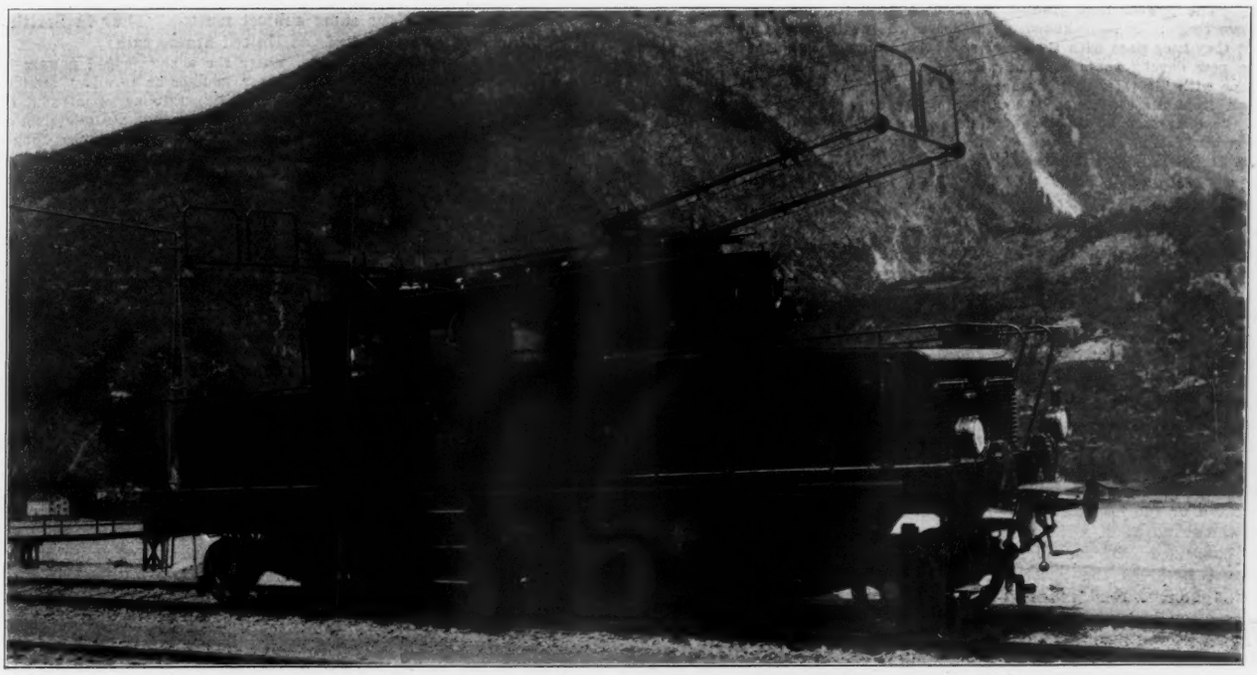


Suspension of Trolley Wires in the Simplon Tunnel.



South Portal of the Simplon Tunnel at Iselle.

portals. It was built under great difficulties, particularly on account of the heat at so great a depth under the surface of the ground. Streams of hot water poured out into the cuttings and had to be pumped out before work could be carried on. It was early believed by engineers that the tunnel must be worked by electricity rather than with steam locomotives, but the Swiss Federal Railroad authorities took an exceedingly conservative position on this subject, since they regarded electric operation as much of an experiment. When the tunnel was open to operation steam locomotives were run through it, but it was found that the blast from the exhaust loosened the roof, and on every trip glass on the engine was smashed by the stones dislodged; furthermore, the smoke and steam discharged in the tunnel formed so densely in the southern end that the signal light was invisible at a greater distance than 60 yards. About this time the Swiss firm of Brown, Broveri & Co., who were the contractors for building the tunnel, offered to undertake the installation of the necessary electric plant at their own risk, and to put it for a year at the disposition of the Federal Railway Administration so that comparison on a large scale could be made between steam and electric traction. One of the locomotives used in the tunnel is shown in the accompanying photograph, which also illustrates the method of taking the current from the trolley wires. The method of suspension of the conductor at a switch is shown, and also a general view of Brigue station and of the six tracks electrified between Brigue and the mouth of the tunnel, as well as a view of the tunnel portal and of the suspension of the wire inside the tunnel. These photographs illustrate the information given in regard to the electrification in our issue of December 21, 1906.



Three-Phase Electric Locomotive for the Simplon Tunnel Service.

Legislative Centralization.

BY H. T. NEWCOMB,
Of the Bar of the District of Columbia.

It is scarcely necessary to point out that within the last two decades the strong movement toward the centralization at Washington of powers formerly exercised at the several state capitals, which began with the Civil War, has gone forward with added impetus. The various steps in this advance need only to be enumerated to indicate how profoundly it must affect the lives of the American people and the character of their government. The Interstate Commerce law, enacted in 1887 and greatly strengthened in 1889, 1891, 1893, 1903 and 1906; the Sherman anti-trust law; the various safety-appliance laws; the national quarantine law; the meat inspection laws; the pure food law; the prohibitive tax on oleomargarine; the creation of the Bureau of Corporations in the Department of Commerce and Labor, and the federal employers' liability law are all steps in a progression that has already done much to destroy home-rule in the states of the American union. But the end is by no means in sight. Other plans for subtracting from the powers of the states and adding to those of the central government are even now knocking at the doors of Congress and absorbing much of the interest of the chief executive and his cabinet ministers. It is proposed that without a federal license no corporation shall be permitted to manufacture articles to be consumed beyond the boundaries of the particular state in which they are produced and that by granting or withholding these licenses the general government shall control the ownership of the factories and the conditions under which they shall operate. Further, it is urged that there shall be federal regulation of insurance, of hours of labor in various employments, of child-labor, of marriage and divorce, of accumulations of private wealth and in some cases of admission to the public schools. And from no less an authority than Secretary Root comes the announcement that the states cannot hope to retain their reserved powers unless they exercise them to the satisfaction of the central government. That is, in short, unless the results obtained by state legislation are substantially equivalent to those desired at Washington the power to legislate will be taken from the states and centralized at Washington. If this is what the people of the United States desire there need be no doubt that it will eventually be secured. If the people of the several states do not wish to regulate their domestic concerns, home rule will not long be forced upon the reluctant commonwealths.

It is to be observed that those who advocate the programme of centralization rely chiefly, if not wholly, upon the commerce clause of the Constitution. By successive advances in the interpretation of this clause they hope to so broaden its application as to bring within its scope much that has heretofore been regarded as subject merely to local control. This provision is admittedly elastic and the propriety of its extension to meet the real demands of developing conditions has already been the subject of judicial comment. Thus in Pensacola Telegraph Company vs. Western Union Telegraph Company (96 U. S.) the Supreme Court said:

"The powers thus granted are not confined to the instrumentalities of commerce, ... known or in use when the Constitution was adopted, but they keep pace with the progress of the country, and adapt themselves to the new developments of time and circumstances. They extend from the horse with his rider to the stage-coach, from the sailing vessel to the steamboat, from the coach and steamboat to the railroad, and from the railroad to the telegraph, as these new agencies are successively brought into use to meet the demands of increasing population and wealth. They are intended for the government of the business to which they relate at all times and under all circumstances."

Yet in spite of the perfectly proper latitude of interpretation, which the foregoing suggests and sanctions, there are plain limits beyond which interpretation cannot go without an obvious departure from the principles approved by the founders of the Republic. If, for example, Congress can exclude from interstate commerce the products of the labor of children below the age of 16 years, as recently proposed by Senator Beveridge, it can doubtless do much to eradicate an evil which all good men should condemn, but one that the least acquaintance with the historical development of the American system of government shows was intended to be left to the separate control of the conscience and intelligence of the several constituencies of the respective states. The broad question is whether in concentrating power at Washington the gain, by the possible correction of evils which some of the states are too short-sighted or too inefficient to control, is greater than the loss involved in the removal of authority further from the field in which it must be exercised. Of course no one will overlook the fact that this removal involves the possibility, if not indeed the probability, that throughout whole states and even larger sections, the authority may often be exercised in a manner directly opposed to the wishes of overwhelming majorities of the people.

Whoever fully realizes the fact that the movement is a direct and substantial invasion of the recognized powers of local self-government of the states must regard it as incongruous that so much of its support comes from those whose interests would seem to be most wholly on the side of the perpetuation and strengthening of the home rule principle. Yet although those who work for wages are undoubtedly most to be benefited by home rule and most likely to be injured by the broadening of the legislative or governmental area (as applied to the details of private conduct and the conditions of industrial association) the movement toward centralization has gained much of its strength from the very general support of organized labor. Consider, for example, the Employers' Liability law enacted by the present Congress. The scope of this statute is shown by the extract from the sentence with which it begins that follows:

"That every common carrier engaged in trade or commerce in the District of Columbia, or in any Territory of the United States, or between the several States, or between any Territory or Territories and any State or States, or the District of Columbia, or with foreign nations, or between the District of Columbia and any State or States or foreign nations, shall be liable to any of its employees, . . ."—Public No. 219, 59th Congress, I. Session, Chapter 3,073.

Note that this statute, by its terms, applies to "any (i. e., every) employee" of "every common carrier" engaged in interstate or foreign commerce (as well as in commerce within the District of Columbia or any territory) whether such common carrier uses a wheelbarrow on a turnpike, a sail boat on a river, a steamboat or a railroad car, as the instrument of transportation. It applies, if it has any force at all, to the ticket seller of the trans-Atlantic steamship company, although he may never, in following his vocation, leave his Broadway office except to go to his home near Central Park, and it applies to gate-tenders in the Illinois Central Railroad's local Chicago stations, although many of them may never leave the state of Illinois for any purpose and the trains for which they open the gates are suburban trains running wholly within the state. Even as applied to the employees of railroads which are actually interstate in character, statistics show that out of 1,296,121 employees (the number on June 30, 1904, the latest date for which the Interstate Commerce Commission has as yet supplied the figures) there were less than 250,000 who, by any possibility, could be required to cross state lines in the performance of their duties. Yet the law applies as much to the 46,037 general office clerks; the 154,920 station employees; the 46,272 machinists; the 53,646 carpenters; the 159,472 "other shopmen"; the 326,653 section foremen and trackmen; the 46,262 switchmen, crossing tenders and watchmen, and the 30,425 telegraph operators as it does to the engineer or conductor on the fastest express between Philadelphia and Jersey City. Why should the contract held by the carpenter who works in Omaha for the Union Pacific be regulated by a federal statute while that of the carpenter who builds a house in the same city for an officer of the same railroad is controlled by a different law enacted at Lincoln? Yet, if the federal employers' liability law is constitutional at all, that is precisely its result.

But that is not all. While there are certain matters affecting interstate commerce upon which the states may legislate unless and until Congress chooses to act upon them, the legislative power of the states is wholly ousted the moment Congress acts, and when a law is passed at Washington it has the effect of repealing every state law dealing with the same subject matter. Thus in Smith vs. Alabama the Supreme Court of the United States said:

"There are many cases, however, where the acknowledged powers of a state may be exerted and applied in such a manner as to affect foreign or interstate commerce without being intended to operate as commercial regulations. If their operation and application in such cases regulate such commerce so as to conflict with the regulation of the same subject by Congress, either as expressed in positive laws or implied from the absence of legislation, such legislation on the part of the state to the extent of that conflict must be regarded as annulled."—124 U. S. 465.

And, again, in Gulf, Colorado & Santa Fe vs. Hefty & Lewis, that august tribunal said:

"It is unnecessary to pursue this discussion further. The state statute and the national law operate upon the same subject-matter, and prescribe different rules concerning it. The national law is unquestionably one within the competency of Congress to enact under the power given to regulate commerce between the states. The state statute must, therefore, give way."—138 U. S. 104.

It is not admitted that the power to regulate interstate and foreign commerce implies the right of Congress to fix the terms of the contracts between "every common carrier" engaged in such commerce and every individual in its employ. That fundamental question has been decided in the negative by two federal courts, but it will not be set at rest until it has been passed upon by the Supreme Court. The Attorney-General of the United States, at the direction of President Roosevelt, intervened to support the affirmative side in the lower courts and will undoubtedly appear in the appealed cases. But, if Congress has the power thus claimed, attention is here directed to the fact that until Congress exercised it the states could control these contracts. And they had the power, which no one asserts reposes in Congress, to deal comprehensively with the whole subject of the liability of employers to employees within their several boundaries. The employers' liability law adopted at Lincoln, Nebraska, could control the contract held by the carpenter employed

in house-building as well as his confrere in the Union Pacific shops. When Washington acted it could, at the most, deal only with the latter but in acting, if it has power to act at all, it has ousted Lincoln from all control over him. Among the states whose employers' liability laws, presumably satisfactory to the majority of their own citizens, were thus modified or repealed by the action of the Fifty-ninth Congress are Kentucky, Georgia, Iowa, Kansas, Wisconsin, Minnesota, Florida, Ohio, Mississippi, Texas, Arkansas, South Carolina, Missouri, North Carolina, North Dakota, Alabama, Massachusetts, Indiana, Colorado, Utah, Maryland, Virginia, Oregon and Montana. Possibly some of the citizens of these states are better satisfied with the terms of the federal statute than by those of their own states, but, whether they are or not, there can be no doubt that their power over the rules by which they are controlled is much smaller when those rules are made at Washington than it is when they are made at home. If hereafter Congress refuses or neglects to satisfy their local needs, however evident, or their local wishes, however unanimously expressed, by modifying, repealing or retaining the statute, they will be practically helpless unless they can enlist the sympathy and secure the active assistance of residents of other states.

Again, if the power asserted in the employers' liability law actually exists in the Congress, the limit of interference with matters hitherto regarded as properly subject only to local control is enormously increased. For example, every state, and by lawful delegation, nearly every municipality, has the power to prescribe the materials of which buildings shall be constructed in order to limit the risks and losses from fire. But the burning of a roundhouse in (say) Philadelphia might delay an interstate train between Washington and Jersey City. Therefore the material of which roundhouses are constructed "affects" interstate commerce. It does so just as plainly as do the qualifications of the telegrapher at a New Jersey station who was hired in New Jersey, who never leaves New Jersey in the course of his duties as an employee, who is paid in New Jersey and who may spend his whole lifetime without ever leaving the boundaries of that state. And if Congress can fix the liability of the railroad corporation to the telegrapher, because the railroad is engaged in interstate commerce and the telegrapher's duties thus "affect" interstate commerce, Congress can also require the Philadelphia roundhouse to be built of fireproof materials. And if Congress can require fireproof materials it can require slow-burning materials or permit the most inflammable type of construction, and can do either even though the city of Philadelphia, for every building subject to its control and in the same vicinity, has required absolutely fireproof material. Thus if Congress can do what, in this particular, organized labor has asked it to do it can also endanger the life and property of every workman in Philadelphia by authorizing that which the citizens of Philadelphia would refuse to permit.

The employers' liability law of 1906 has been discussed at some length because it is a typical instance of a piece of completed centralizing legislation of the kind that organized labor is continuously seeking at Washington. Much the same governmental principles are at stake in the eight-hour bills, the anti-injunction bills, the telegraphers' bills, the arbitration bills and the railroad trainmen's hours of labor bills that are now pending.

The last named measure is of particular interest at the present time because it is not wholly unlikely to receive favorable action at the present session of Congress. It proposes to fix a maximum restriction upon the hours of labor and to prescribe a minimum interval of rest for every "employee engaged in or connected with the movement of any train" in which interstate commerce is "hauled" or by which it is "affected," except in the case of a very limited class of emergencies. Of course whatever power Congress may have to regulate the hours of labor of the adult males who constitute the class of workmen covered by this measure must be based upon some actual relationship between the hours of labor and the frequency of accidents. In other words, the power is essentially a police power and, therefore, must be one which state legislatures can exercise in the absence of Congressional action. If there is no such relation, no such legislative power exists anywhere in the United States. But no less an authority than Mr. E. E. Clark, now, by appointment of President Roosevelt, a member of the Interstate Commerce Commission and formerly Chief of the Order of Railway Conductors and a member of the Anthracite Coal Strike Commission, declared, in his testimony before the Industrial Commission, that the exceptional instances in which trainmen work long hours are caused by the reluctance of railroad managers to increase the "possibility of accident" by putting on too many new men when business is extraordinarily heavy.

Another peculiarity in the situation is that this restriction is being urged by labor leaders in the face of the fact that it is not wanted by the rank and file of the members of their organizations. Thus Mr. W. P. Borland, a former trainman now in the employ of the Interstate Commerce Commission, in a capacity which affords abundant opportunity to learn the views of trainmen, and an advocate of the bill, while testifying before the Committee on Interstate and Foreign Commerce of the House of Representatives, on April 20, 1906, said:

"A majority of the men do not desire this legislation, and I think if they were brought here they would say so. Now, in that connection I want to say, that before the Industrial Commission, Mr. Frank Sargent, who is now Commissioner-General of Immigration, and was then Grand Master of the Brotherhood of Locomotive Firemen, testified on this very question. In answer to a question by Mr. Phillips, of the Commission, he said, and, I think, stated the fact:

"'The men in the railroad service do not want an over production. They do not want the railroads loaded down with men, in order that they may have it easy the whole year 'round. They are willing to take it rougher and work a little harder in the busy season, and then when the dull season comes there is plenty of time to rest up and earn fair wages. The railroad employees have an understanding with the employers that there shall be no more men employed than is necessary to move the traffic with despatch, and during the busy season they take advantage of it and earn big wages, and when the dull season comes of course they earn the average wages.'

"I think that is the attitude of the great majority of railway employees."

More recently still the opposition of other railroad trainmen has been expressed in resolutions adopted by the local lodges of their great organizations. The following resolutions adopted by Thomas Dickson Division No. 171 of the Order of Railway Conductors are both strong and typical:

"Whereas, There are now pending in the Congress of the United States measures intended to take away from the men employed in the train service of interstate railroads the right to dispose of their services under conditions and upon terms satisfactory to themselves, and

"Whereas, the nature of the railroad business imposes conditions little understood by the general public; among them the fluctuations in train-movement from week to week, from month to month, and season to season which create corresponding variations in the quantity of train service required and consequently in the demand for the labor of trainmen, and

"Whereas, the efficient handling of the public business entrusted to interstate railway carriers requires the arrangement of runs of train crews so that, in many cases, the distances covered cannot always be traversed, when conditions are at all adverse, within sixteen hours and this is especially true of what are known as 'turn' runs which, however, are universally preferred by train crews because they permit the lay-overs to be spent at their homes with increased comfort and reduced expense, and

"Whereas, the restriction of the hours of labor by imposing a statutory maximum of sixteen hours, with exceptions only in case of casualties occurring after the runs begin, would require the railroads to keep upon their pay rolls a greatly increased number of men to handle the traffic at the period of its greatest volume, but many of whom would be idle much of the time during most of the year and would, thus, greatly reduce the average annual earnings of all classes of trainmen, and

"Whereas, the railroad trainmen of the United States are of full age, possessed of sound minds, equipped with an intelligent comprehension of their own interests and of the business in which they are engaged, and are fully able therefore to look after themselves in their dealings with their employers; now, therefore, be it

"Resolved, That we, the Thomas Dickson Division, No. 171, of the Order of Railway Conductors, condemn any legislative proposal for the restriction of the number of hours during which railroad trainmen shall be permitted to dispose of their labor, and we especially protest against the passage of the bill known as S. 5133, introduced by Senator La Follette, or any similar measure."

Such is the attitude of the trainmen toward centralizing and liberty-impairing legislation advocated in their name by those who claim to represent them at Washington. No one desires long hours of labor for railroad trainmen, nor is there any practice of requiring or permitting excessive hours in the transportation service. But if legislation on the subject is needed it should be enacted by the states, by those legislators who are near to and directly cognizant of the needs of different communities. If left to such legislators there would be little chance of the enactment of a clumsily drawn and ill-considered measure which, like that under discussion, would force a serious congestion of the railroad industry, with added delays, inconvenience and loss to shippers and consumers, by putting in force statutory rules which could be complied with only by vast increases in the number of men employed; in terminal, yard and side-track facilities; in motive power, and in car equipment at a time when all available men are employed and the capacity of the rolling mills, locomotive shops and car building shops is already taken up by orders most of which cannot be filled within the next 12 months.

These special objections to particular phases of the centralizing movement that is being pressed by organized labor, or its legislative agents, are parallel with those applicable to other items in the general program. How much force they will have in preventing its full execution is problematic. The best defense against too rapid centralization in these and other matters would be found in an aroused sense of the value to each individual citizen of real local self-government. Next in importance to such a sentiment is a vigorous assertion by every state legislature and every state court of last resort of the right of each state to control its domestic affairs and the exercise of such control at each state capitol, positively or negatively, as circumstances may require, in accordance with the safe and self-reliant principles which have the sanction of American history and progress.

New Lehigh Valley Bridge Over the Susquehanna River, Near Towanda, Pa.

BY PHILIP H. DE WITT, M. AM. SOC. C. E.

One of the most important improvements under way on the Lehigh Valley at the present time is the change in alinement and grades between Wysox and west of Towanda, and a new bridge over the Susquehanna river at Towanda. The entire work covers about 6½ miles. Fig. 1 shows the lines and grades adopted after careful study of the conditions. Numerous lines were projected and estimated on, including several crossings of the river into Towanda, with the idea of a more convenient location for a passenger station for the town; but the excessive cost of the crossing and of right of way caused the abandonment of the scheme and the adoption of the

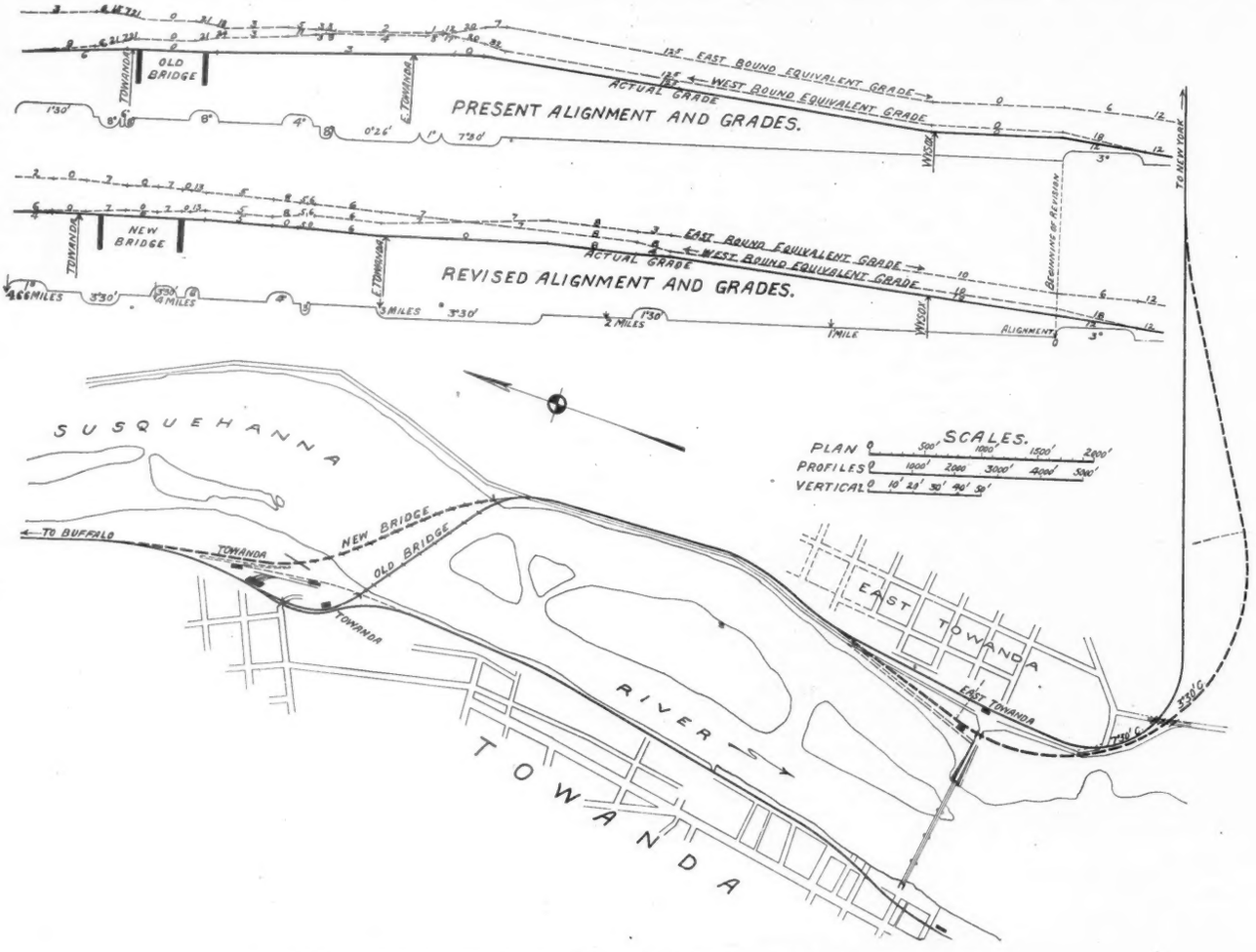


Fig. 1—Change of Line and Grade on the Lehigh Valley Near Towanda, Pa.

Fig. 2—General View of Old Lehigh Valley Bridge Near Towanda and Completed Masonry for New Bridge.

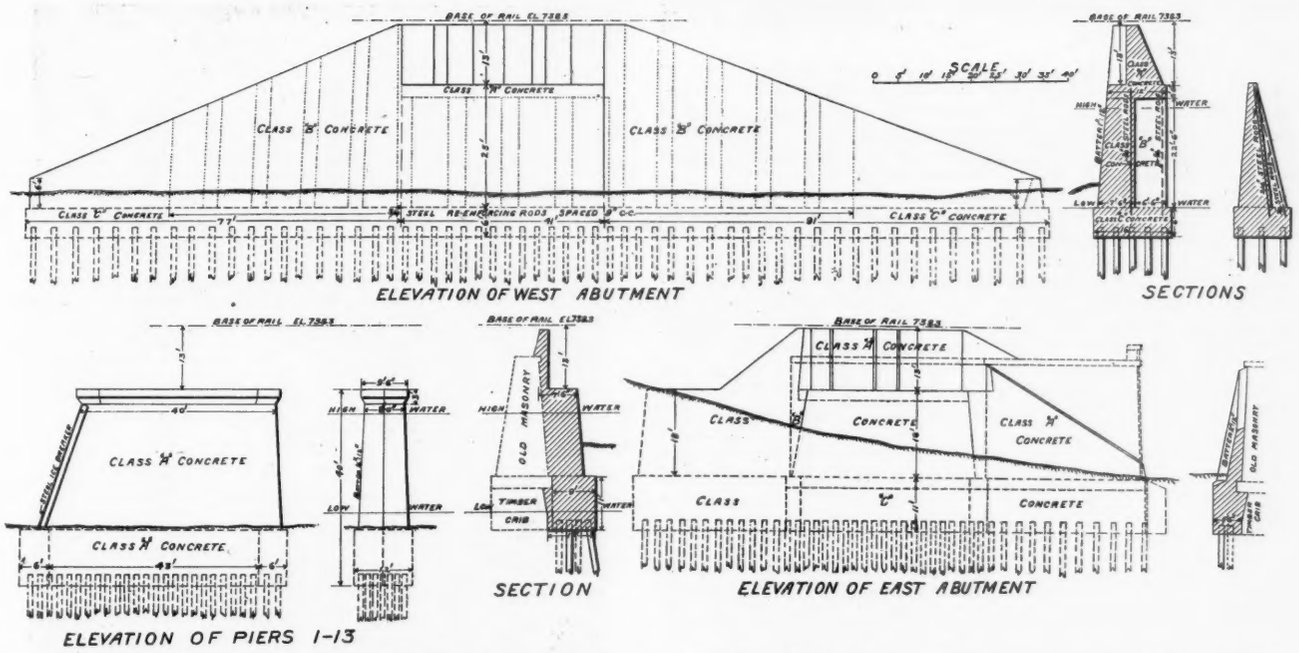


Fig. 3—Details of Concrete Piers and Abutments for New Bridge of the Lehigh Valley Over the Susquehanna Near Towanda, Pa.

line as built. The combination of grades and curvature on the present line between Towanda and Wysox make this the limiting point for train loads on the engine run between Coxton and Sayre for both eastbound and westbound trains.

The profiles on Fig. 1 show the conditions existing here before and after the changes, actual and equivalent grades being given in each case. The next limiting point on this division is at Vosburg tunnel, where the conditions are such that there is but little opportunity for their betterment. It was therefore decided that if the grades and alinement between Towanda and Wysox were reduced to such an extent as to make Vosburg the limiting point for the engine run, the improvements would be ample. Computations of the reduction in train mileage due to heavier trains that can be hauled over the revised line, including heavier motive power over the new bridge, further showed a capitalized annual saving in excess of the entire cost of the improvement, including the cost of the new bridge, which justified the outlay. Two objectionable grade crossings are also eliminated, and a new station provided for Towanda.

Fig. 2 shows a general view of the completed masonry for the Susquehanna river crossing. The old masonry of the present bridge was built in 1865, the piers being sunk in the deep water of a dam located just below it. When the dam was subsequently carried out in 1874 it left these cribs exposed to the elements.

The new bridge is built with 3 deg. 30 min. curves at each end in place of 7 deg. 30 min. curves in the old bridge, which limited the train tonnage. The piers of the new bridge are spaced closer than in the old bridge, so as to allow deck plate girders to be used in place of truss spans. The new bridge is being built without interfering with the operation of the road, which would not have been unavoidable if the old structure had been remodeled, an important condition on a busy line.

The new bridge will consist of 14 spans of deck plate girders, all of which are 129 ft. 6 in. long over all and 10 ft. 1½ in. high, except for the east span, where the spacings are odd, owing to the skew of the east abutment. The total length of the crossing is 1,801 feet from abutment to abutment. The distance from base of rail to top of masonry is 13 ft., and the girders weigh approximately 65 tons each. The girders are now being erected by the Phoenix Bridge Co., Phoenixville, Pa., the contractors for the steel

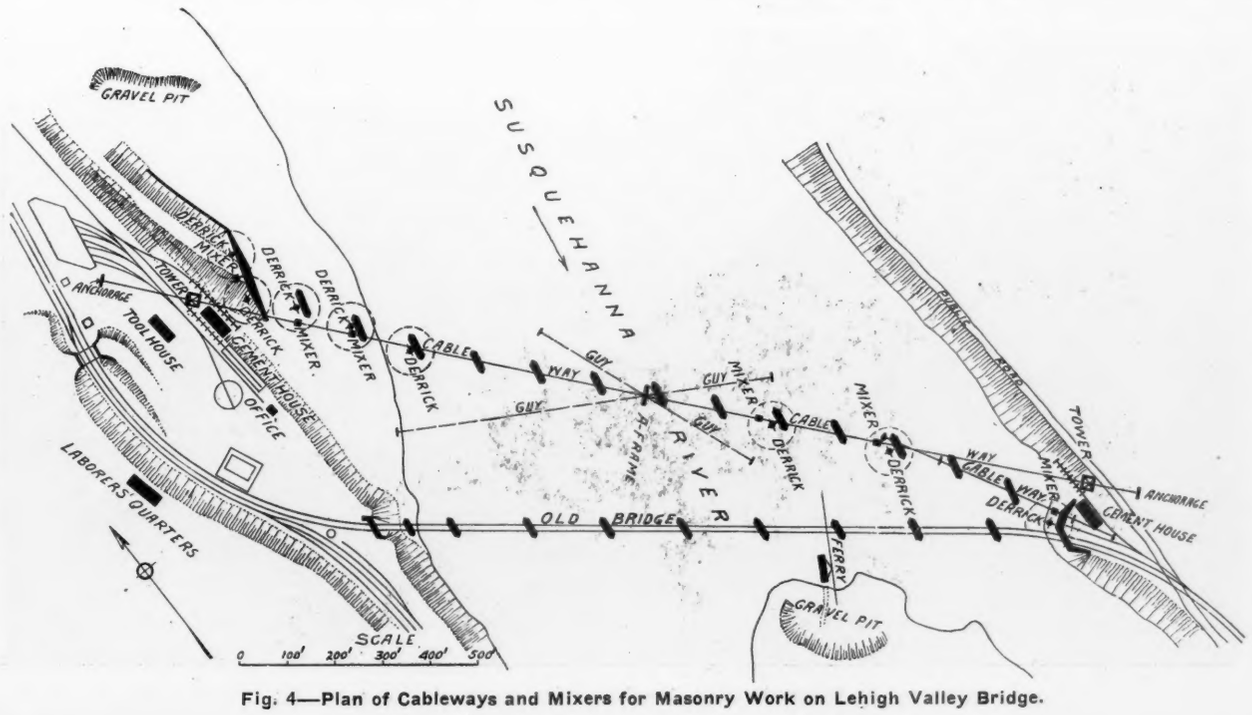


Fig. 4—Plan of Cableways and Mixers for Masonry Work on Lehigh Valley Bridge.

work. They will be erected by a cantilever traveler without the use of false work, owing to the risk from highwater and ice at this season of the year.

The masonry consists of 13 piers and two abutments, all of concrete, resting on piles. Fig. 2 shows a general view of the completed masonry, and Fig. 3 the details. The east abutment is faced against the north wing of the old east abutment. The 13 piers are all of the same general design, the principal dimensions being shown in Fig. 3.

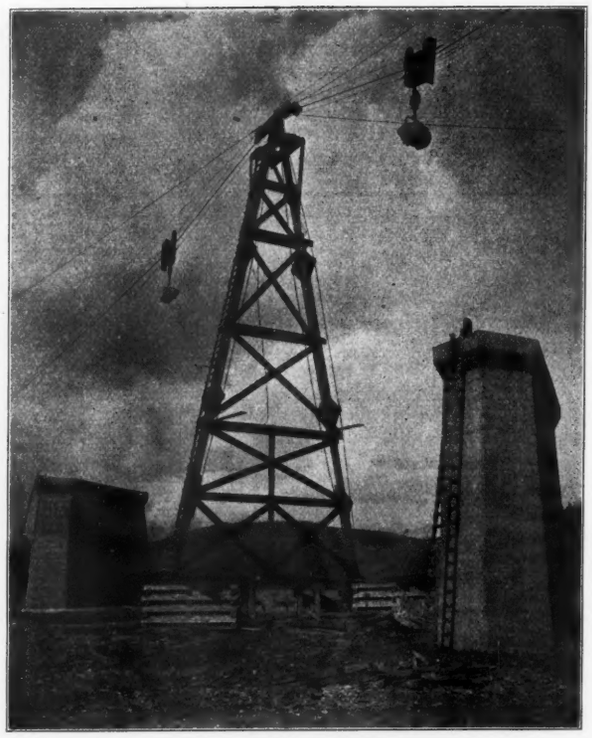
The foundations were excavated by hand inside of clay puddled cofferdams to the specified depth below the river bed, after which the piles were driven in each foundation and cut off level two feet above the bottom of the foundation. Oak piles were used throughout and were driven with drop hammers. At first a water jet was used in driving, but it was found that the nature of the material, which consists of coarse gravel and sand was not suited to the use of the jet and it was discontinued. Piles could be driven just as deep and more rapidly without the jet than with it, and with less disturbance to the material in the bottom of the foundation. After the piles were sawed off the foundation pumps were stopped and the foundation concrete was then deposited through steel chutes of varying lengths. The pumping was unusually heavy in the pier foundations, as many as four 6-in. and 8-in. centrifugal pumps being used on a foundation owing to the large amount of water coming up through the bottom.

The west abutment is of reinforced steel construction. The back of the abutment is pocketed and reinforced with ¾-in. steel rods. The high price of lumber and labor required to build the complicated form necessary for this abutment probably counterbalanced the saving in concrete due to the pockets. The abutment rests on piles and contains about 2,000 cubic yards of concrete.

River gravel was used throughout in the concrete. The concrete was mixed in Ransome mixers in the following proportions: Piers, including foundations, 1-2-4; abutment foundations, 1-3-6; abutment neat work, 1-2½-5, with the exception of the back walls and coping, which were 1-2-4.

The contract for the masonry was awarded on April 4, 1906, preliminary and shore work was started April 15, but owing to high water the river work was not started until July 9. Notwithstanding these delays, the work was completed October 29, 1908, which was over a month before the expiration of the date for completion of the contract. In other words, the 11 river piers were completed in less than four months.

In order to complete the work within the required time, a large plant was required to take advantage of the short working season of low water, and all preliminary work possible was done so that the plant would be ready when the river was favorable for foundation work. The general layout of the plant is shown in Fig. 4. Three cableways supplemented by derricks were employed. The main cableways consisted of a double Lidgerwood plant, of 1,000 ft. span each, supported on the shore ends by 80-ft. towers containing the machinery and in the center with a 75-ft. A-frame tail tower on pile bents, guyed in four directions. This double cableway was designed for a working load of three tons, with an occasional overload of seven tons, which was sufficient to pick up and set mixers, piledrivers and hoisting-engines, in addition to regularly hauling concrete and other materials. A track was located under each cable at the shore towers so that machinery could be handled directly from railroad cars.

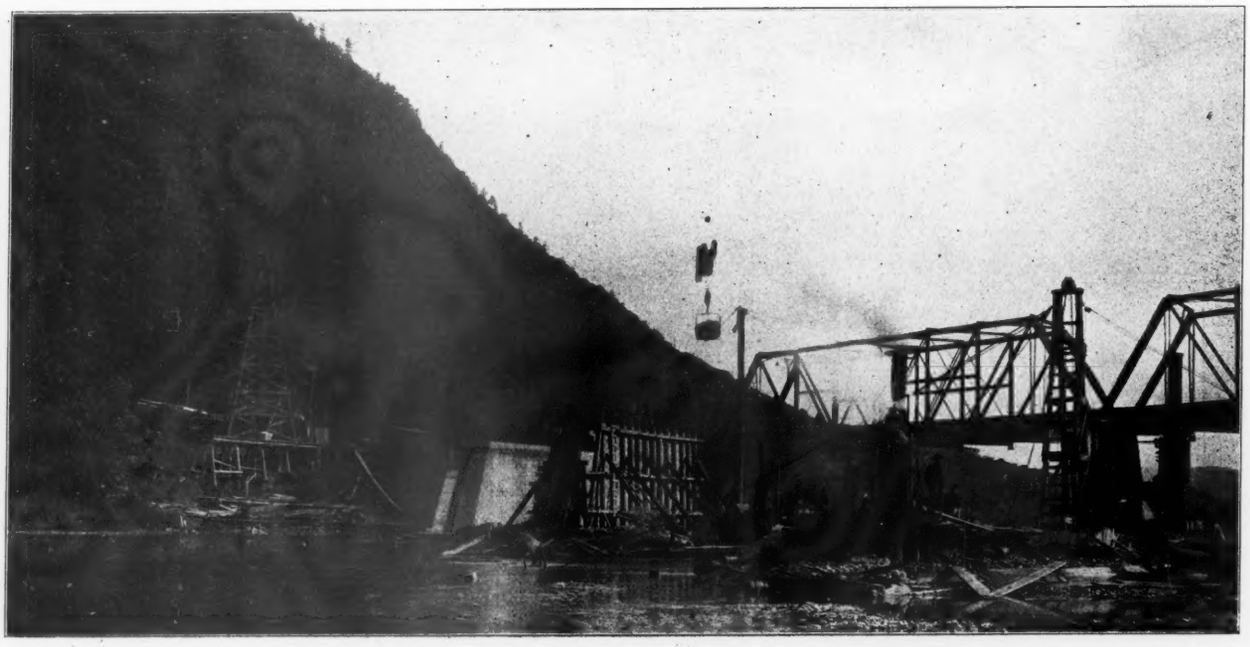


A-Frame Cableway Tower in Middle of Stream.

A smaller cableway of 500-ft. span was used to build the east abutment and piers 1 and 2 (on the east curve). The west abutment and piers 11, 12 and 13 (on the west curve) were built with derricks. This arrangement of the plant made it possible to carry on the work simultaneously at four independent points.

Two piledrivers, three mixers and six centrifugal pumps were required. The various positions of the derricks and mixers are shown in Fig. 4. The plant in the river was blocked up sufficiently high and guyed to provide for an ordinary summer rise in the river.

The entire work proved to be well suited for cableway construction, and it is doubtful whether any different equipment would have done the work within the time without considerable additional ex-



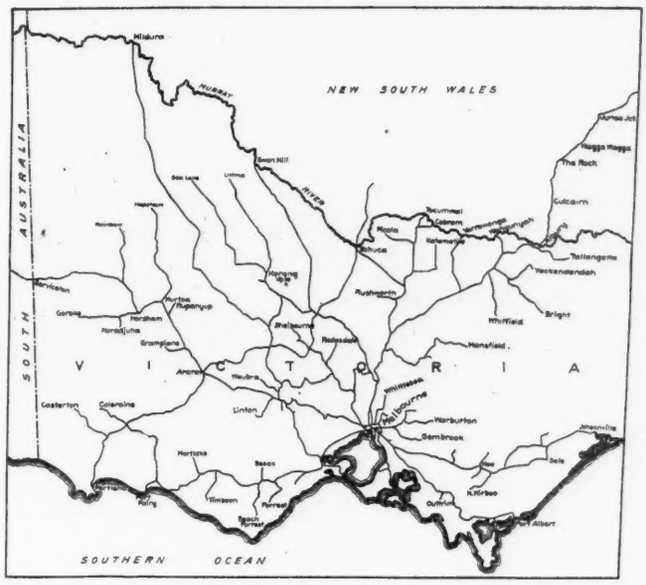
Working Plant for Building Concrete Piers of New Towanda Bridge.

pense. The double-span Lidgerwood cableway, attached to the A-frame tail tower, is believed to be a novel arrangement. The A-tower was guyed rigidly in four directions in order to prevent the vibration of one side of the cable being transmitted to the other and interfering with the independent operation of the two plants.

The masonry and superstructure work was done under contract by S. B. Mutchler & Co., Phillipsburg, N. J. The improvements are being carried out under the direction of Walter G. Berg, Chief Engineer; F. E. Schall, Bridge Engineer; and E. H. Shipman, Assistant Engineer, Lehigh Valley.

The Railroads of Victoria.

The accompanying map shows the government-owned railroad system of Victoria, Australia, which includes all the railroads of



The Railroads of Victoria.

that colony. In the editorial columns will be found a review of the work of an American railroad officer who has been at the head of the Victorian Railroads for the past three years.

Safety by Legislation.

The letter which follows was written as a personal letter to one of our staff, an old and close friend of the writer; this explains the informality of expression. We have asked permission to print the letter as it was written, retaining the personal quality as, incidentally, it shows how an editor writes when he is unharnessed.—EDITOR.

Swissvale, Pa., Jan. 19, 1907.

My Dear Adams.—I am going to tell you some of the things that I think about block signaling and about the possible good in government interference. Of course, what I think is not important, but in the endeavor to formulate it for you I may clear my own ideas and may perhaps suggest something to you.

I have always been opposed to specific legislation in such matters, and to attempts on the part of government to meddle with details. Any Congress or any state legislature will average far below the railroad officers who have responsibility, in intelligence, in moral character and in knowledge of matters pertaining to railroading. The chances that any legislative body will be able to evolve any legislation that is of any value in controlling railroads in matters of safety are extremely small. Legislation will be suggested and directed by people whose knowledge is superficial, whose interests are transitory, or whose interests are mercenary. I have always believed that enlightened selfishness on the part of the railroad officers would in the long run accomplish a great deal more than efforts at legislation. It is probable that legislation has been useful in the matter of air-brakes, couplers and heating apparatus. It is quite improbable that it would be useful in the matter of block signals, unless it were made very general indeed in its terms. The air-brake and the coupler, and the methods of heating, had been tried out and the standards had been fixed and mechanical conditions simplified before any state or federal control became effective. Block signaling is to-day in a state of rapid evolution, and any attempt at specific legal restrictions or requirements would be based on transitory conditions and often, probably, on mechanical errors. Therefore, if the federal and state governments must legislate in the direction of compulsory block signals, let them make the legislation very general, so as to permit telegraphic block, automatic block, lock and block, train staff, cab signals, or even wireless signaling.

It might be well to increase the pains and terrors of killing and wounding people. It might be well to impose very heavy fines and imprisonment, unless it can be shown that the killing and wounding was unavoidable. But are there not enough laws now to do that if the laws are enforced? Even this very general legislation that I have suggested seems to involve better machinery for investigation than is now at the command of the Interstate Commerce Commission or any of the state commissions. The British Board of Trade inspectors have a dignity, an authority and a range of knowledge much beyond anything that can be brought to bear in this country. A gentleman of much observation and sagacity has just suggested to me that it would be well to provide a board of inspectors made up of men who could command salaries of $25,000 a year. This expressed conveniently the grade of character, attainments and ability necessary in a board charged with the responsibility of investigating accidents and deciding upon the adequacy of material and methods.

At this moment there are many people active in the promotion of nostrums, and the peril is that these people may impose their plausible ideas upon the President, the Interstate Commerce Commission, and members of Congress and of the state legislatures. Within the last few years there has been a great deal of invention in the way of cab signals, train stops and the like. I suppose that I must have turned down an average of about one inventor every two months of that sort for the last two or three years. Within two hours I have had before me the project of an inventor who knows that tens of thousands of lives could be saved every year, and millions of dollars, by the use of a wireless signaling system. Of course, we shall look into his system, but the chances are 100 to 1 that it will not be worth spending an hour's time upon. It is my principle never to turn down an inventor arbitrarily without giving his invention as reasonable consideration as limitations of time and skill will permit. I make myself a great nuisance to our engineers in that way, and have caused them to waste many hours by such examinations.

As for the automatic stop, I am somewhat uncertain what to say. I opposed it in the New York Subway when we were laying out that scheme of signaling. I am now satisfied that I was wrong in that opposition. If I were obliged to say yes or no to-day to any project for using automatic stops on an ordinary steam railroad, I should say no; and yet, I am not certain that I should be right in that decision.

The question of the automatic stop for ordinary railroad use is complex. There are serious objections to putting it overhead or alongside. As you well know, an arrangement by which an automatic stop fixed overhead or alongside shall engage with a brake valve or other contrivance on a moving vehicle, must work within narrow limits. The danger of hitting men on top of the train, or men hanging out one side to give hand signals, or for other purposes of operation, would be considerable. Furthermore, variations in line and surface of track would change the relative positions of the two parts of the apparatus and put them out of adjustment. Consequently, it seems likely that it will be best to attach the trip to the ties so that the relative positions will not be seriously changed by variations in track. But then you come into the difficulties of snow and ice, and your trip is liable not to be operative at the critical instant. Doubtless you have already thought over the complications in signaling and the delays to traffic that the automatic stop will introduce.

Beyond this, and more important than this, to my mind, is the effect on the engineman. He is none too attentive to his duties now, and none too obedient to the rules. If he knows that something along the track is going to stop him if he over-runs a signal, will not the consequence be that he will become still less attentive? But we know that he ought never to relax his vigilance, for reasons other than the mere picking up of signals.

With regard to the automatic stop, then, I should say that it would be a misfortune to have any compulsory action on the part of any branch of the government. I should say, let the thing work itself out. Increase, if necessary, the penalties imposed upon railroad officers and employees for killing folks; but let them work out their own means of avoiding these penalties.

When you analyze collisions, you will find that they are almost without exception cases of defective discipline. At the moment I do not think of any single exception; and here is, beyond all comparison, the greatest cause of the terrible situation on the railroads of the United States. Discipline has sunk to a condition below anything that has existed since I have been watching railroads. Of course, you know how limited are the opportunities that you and I have for judging of this important matter, but I do not believe that I am far wrong in that opinion. This low state of discipline may be attributed more to labor unions than to anything else. It is very little a question of long hours; it is very little a question

of shiftlessness on the part of superintendents and other officers, but it is very greatly a matter of demoralization, due to the growth of the trade union idea. Another element is the tremendous demand for men, in consequence of which a man is no longer very much afraid of losing his job. The men have grown insolent, they have grown indifferent, they have lost respect for authority, they have lost their sense of duty; they have been taught by the newspapers of the country that they are a down-trodden and oppressed body, they have been taught that corporations and their officers are wicked; the whole tone of the press and of the pulpit has been to breed insubordination and a chronic sense of grievance. Take, for example, the instance of the Terra Cotta accident on the Baltimore & Ohio, and apply to it this idea.

Of course I do not mean to say that the railroad corporations and their officers are entirely without fault. In all ranks there are railroad men who have been somewhat demoralized by growing familiarity with the idea that railroads are not transportation machines, but rather opportunities for speculators to make money. That condition has had much to do with the decline of discipline, and, furthermore, the technical men have had in recent times less and less to say in the matter of purchase of apparatus and selection of methods and material. So-called business considerations have more and more controlled. So here again we get a bad result from the predominance of the speculative theory in the conduct of railroad affairs. Some of the great financiers who have taken control of the railroads see this danger clearly and try to build up the power and ability of their technical staff.

By the way, the matter concerning which I wrote to you some time ago, viz., the remorseless demand for speed, has a great deal to do with these collisions; but that is a subject by itself.

H. G. PROUT,
Vice-President and General Manager Union Switch & Signal Co.

Interstate Commerce Commission Tariff Rulings.

The Interstate Commerce Commission has issued two tariff circulars, No. 8-A and No. 9-A, the first containing "regulations governing the construction and filing of freight tariffs and classifications," and the other "regulations governing the construction and filing of passenger tariffs." The regulations are to become effective March 1, 1907. After that date all new tariffs must conform to these rules. Tariffs lawfully on file with the Commission on March 1 will be considered as continuing in force, but the Commission reserves the right to direct the reprinting at any time of any tariff. The regulations cover joint tariffs and joint rates, through tariffs and through rates and also individual rates.

The regulations prescribe the size of the tariff, and forbid reproductions by hectograph or similar process, or typewritten or proof sheets. There shall be shown on the title page the I. C. C. number and cancellations, the kind of tariff, reference to the freight classification as to freight tariffs, when the tariffs are issued and when effective, and the name of the officer issuing. The tariff must contain a table of contents, names of participating carriers, index of commodities, alphabetical arrangement of rates to each destination, index of stations, explanation of reference marks and abbreviations, list of stations, explanatory statements and rules governing the application of rates. No rule or regulation shall be included which in any way authorizes the substitution for any rate named in the tariff of a rate found in any other tariff. The tariffs must also explicitly set forth the rates, together with the names of the places from and to which they apply, all arranged in a simple and systematic manner.

The use of the term "common points" in tariffs is prohibited unless a full list of such points is printed in the tariff or specific reference is given to the I. C. C. number of the issue that contains such list. The same rule applies to such general terms as "grain products," "forest products," "petroleum and its products," and similar terms. Where a commodity or special rate is named, such rate is the only rate that can lawfully be used.

Every amendment to a tariff must specify the cancellations thereby effected and every cancellation notice show specifically where rates will thereafter be found. A change in a tariff shall be known as an amendment, and shall be printed in a supplement to the tariff which it amends. The supplement shall be reprinted each time an amendment is made, and shall always contain all the amendments to the tariff that are in force. There shall at no time be more than one supplement to any tariff, and when the supplement contains 100 amendments in force, the tariff shall be reprinted. When a supplement contains more than 25 amendments, it shall also contain an index to its contents.

Each carrier shall publish and file separate tariffs containing all terminal charges and allowances, together with all other charges and rules which in any way increase or decrease the amount to be paid on any shipment. Every carrier shall publish and file a complete list of the tariffs which it is required to post and which are in effect, and this list shall be reprinted every three months. Commodity tariffs shall be entered alphabetically according to the principal commodity. The concurrence of every carrier participating must be secured and filed with the tariff or amendment by the issuing carrier or its agent.

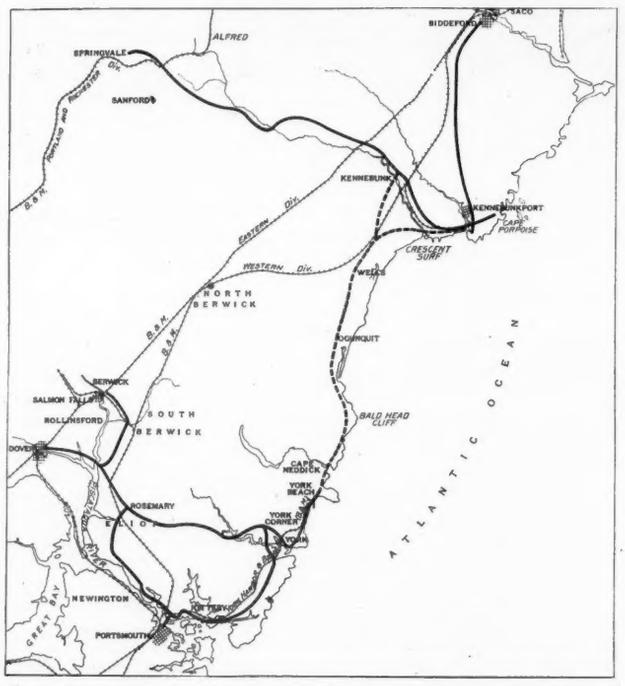
The initial carrier must post all through and joint tariffs; but if in any instance a carrier refuses to participate in through or joint rates to or from its territory and therefore declines to post the through rates, the Commission will give early hearing on complaint against such action and render decision under the provision of the law which confers authority to establish through routes and joint rates.

It will not be the policy of the Commission to permit obstruction to the free movement of traffic by all reasonably available routes, nor to deprive the public in any locality of the advantages of competition among carriers. If it becomes necessary for any carrier to complain of refusal of other carrier to participate in through rate or rates, such complaining carrier may, pending decision by the Commission, use such through rate or rates over the line or lines of the objecting carrier as may have been published and filed, by allowing the objecting carrier or carriers, as their division of the through rate or rates, their local rates between the points on their line or lines where the through rate or rates apply.

The regulations pertaining to passenger tariffs differ somewhat from those for freight tariffs. They contain general rules regarding stop-overs, baggage and excess baggage weights. Special provision is made for the arrangement of points in local and interdivisional tariffs and for statements showing routing.

The Atlantic Shore Line Railroad.

On March 2, 1906, the Atlantic Shore Line Railway, a trolley road operating 35 miles of road from Saco, Me., 15 miles southeast of Portland, to Kennebunkport, and from Kennebunkport east to Springvale, was consolidated with the Portsmouth Dover & York Street Railway, with 42 miles of line running from Kittery, Me., across the Piscataqua river from Portsmouth, N. H., which is



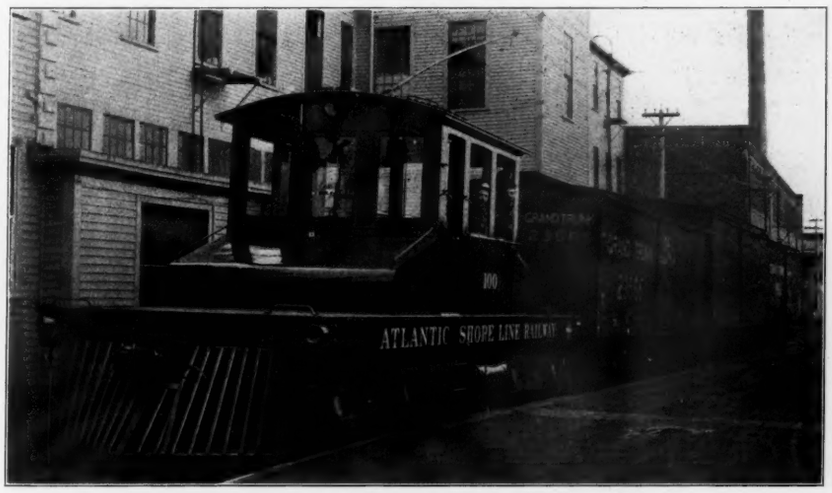
The Atlantic Shore Line, Showing New Connection.

reached by a ferry owned by the company, northeast along the shore to a point beyond York, Me., and reaching by lines running inland, Dover, N. H., and Eliot and South Berwick, Maine. The new company is called the Atlantic Shore Line Railroad, and now has 80 miles of line, which is soon to be increased to nearly 100 miles by a connection 15½ miles long, now being built along the coast between the northern terminus of Portsmouth, Dover & York, and the southern terminus of the old Atlantic Shore Line road, or, in other words, between York Beach and Kennebunk. The accompanying map shows the consolidated system.

The territory reached by this electric road is a flourishing one, particularly in the summer, when the coast towns are filled with summer visitors. Eliot, Kittery, Kittery Point, York Harbor, York Beach, Ogunquit, Wells and Kennebunkport are all summer resorts. The summer local traffic will be large, particularly because the road runs through such an attractive region. On completion of the new

connecting line it will be possible for passengers to ride from Boston to Portland, Me., and beyond to Lewiston or Bath by electric cars. Through traffic, of course, makes up a very small part of a trolley road's business; but the fact that the Atlantic Shore Line forms part of this first through trolley route between the principal city of Massachusetts and of Maine indicates the favorableness of its situation.

Besides the passenger traffic the road does a heavy freight business on its eastern division, that is, between Sanford, Springvale, Kennebunk and Cape Porpoise. The accompanying photograph shows an electric freight locomotive which is used in this service. The side tracks of the Boston & Maine at Springvale, Kennebunk and West Kennebunk have physical connection with the street railway tracks. All the coal and freight to and from the Goodall Worsted Mills is hauled over the eastern division, the steam railroad freight cars being hauled between the mills and the various railroad stations by electric locomotives. A great deal of coal



Electric Locomotive Switching Freight Cars; Atlantic Shore Line.

is also handled between Cape Porpoise and the mills at Sanford, 21 miles. At Cape Porpoise the Atlantic Shore Line owns wharfs, bins and discharging and storing apparatus for coal. The electric locomotives are also used for hauling the railroad freight cars to the different side tracks and points along the line for any purpose, particularly for loading lumber. As the mills at Sanford employ about 4,000 people there is a large amount of freight business done. The Atlantic Shore Line has three locomotives like the one shown and two box car locomotives. An extension of the company's activities is planned which will give the road a through freight traffic. Wharf privileges have been acquired at Boston, Portsmouth and Kittery and extensions to the wharves at Cape Porpoise are planned with the intention of establishing a steamboat line between Boston and Cape Porpoise touching at Portsmouth, N. H. It is expected that a great deal of freight will be handled by this line between Portsmouth, Dover, Rochester and Salmon Falls, N. H., and South Berwick, Eliot, Kittery, York, Kennebunk, Wells, Ogunquit Sanford, Springvale, Kennebunkport and Biddeford, Maine.

The Atlantic Shore Line has $700,000, 4 per cent. preferred, and $2,000,000 common stock, and an authorized issue of $3,000,000, 4 per cent. 20-year refunding bonds. For the 12 months ended October 1, 1906, gross earnings were $297,000, net earnings $132,500, and surplus above fixed charges and taxes, $85,000. This is at the rate of about $3,500 gross earnings a mile.

Railroad Decisions in January.

The following decisions were handed down by Federal and Supreme Courts in January, 1907:

Power to appropriate depot grounds for highway purposes.—The general power conferred on local bodies to establish highways does not empower such a body to condemn for highway purposes land already appropriated under the power of eminent domain for station grounds, when the effect of such second appropriation would be to seriously interfere with their use for this purpose. Chicago, Rock Island & Pacific vs. Williams, 148 Fed. Rep. 442.

Postal clerks as employees.—The Pennsylvania statute providing that postal clerks injured while in the performance of their duties shall have no greater rights than employees suffering injuries does not infringe the power of Congress to establish postoffices and post roads. Neither is it open to objection that it violates the commerce clause of the Federal Constitution, nor does it deny the clerk due process of law or the equal protection of the laws or privileges and immunities enjoyed by citizens of the United States generally. Martin vs. Pittsburg & Lake Erie, 27 Sup. Ct. Rep. 100.

Membership of employees in labor unions.—The Federal act making it a criminal offense for carriers of interstate commerce to withhold employment to railroad men unless they agree not to become members of labor organizations or to blacklist employees on discharge is not in a constitutional sense a regulation of commerce between the states, and being without strict limitation to transactions relating to interstate commerce but equally applicable to commerce not of this character it is unconstitutional and void. United States vs. Scott, 148 Fed. Rep. 431.

Rules for guidance of employees.—A railroad company is charged with the duty to make, promulgate and enforce definite rules and regulations for the guidance and protection of employees, and the employee on his part rests under a like duty of obedience to such rules. Where the rules are mere oral instructions to employees they must be proved by the railroad company where they are relied on as defense to an action for the death or injury of an employee. Seaboard Air Line vs. Shanklin, 148 Fed. Rep. 342.

Reasonableness of commissions' rates.—Federal courts will not review the action of a state railroad commission in fixing a local rate on an article where there is no evidence from which a reasonable deduction can be made as to the cost of transportation, the amount of the article transported or the effect which the rate established by the commissions will have upon the income of the carrier. Seaboard Air Line vs. state of Florida, 27 Sup. Ct. Rep. 108.

Condemnation of stock of minority road.—The Supreme Court of the United States has decided that the improvement of the New Haven & Derby Railroad is a public use entitling its lessee, the New York, New Haven & Hartford, which owns three-fourths of the stock, to condemn the outstanding shares of stock owned by a person who refuses to agree on the terms of purchase of his stock. Such a proceeding is authorized by a Connecticut statute, and when supported by a clear public use as the one in question, which was necessary to develop the property of the parent line, does not violate the due process of law provision of the Federal Constitution. Offield vs. New York, New Haven & Hartford, 27 Sup. Ct. Rep. 72.

Presumption under Ohio railroad employee act.—The provision of the statute making proof of a defect in a railroad appliance causing injury to an employee *prima facie* evidence of negligence is held not to shift the burden of proof of negligence. All that the railroad is required to do to meet this presumption is merely to counterbalance it. It is not required to overcome the presumption. The burden of proof of negligence still rests on the employee. Shankweiler vs. Baltimore & Ohio, 148 Fed. Rep. 195.

Rebates.—The allowance of a rebate to a packing house company is not to be justified on the ground that it was an allowance to the packing company for the use of its own private track in moving the cars to a connection with its own road. The word "rate" in the anti-rebate statute means the net amount the carrier receives and retains and any device by which the amount is reduced below the rate given in the published schedule is a violation of the law. United States vs. Chicago & Alton, 148 Fed. Rep. 646.

Requiring trains to stop at county seats.—An order of a state railroad commission requiring interstate mail trains to stop at county seats already supplied with proper and adequate passenger facilities is an unconstitutional interference with interstate commerce. An injunction against the enforcement of such an order is not open to the objection that it is a suit against a state within the constitutional inhibition, neither is it open to the objection that it violates the statute forbidding the Federal courts to enjoin proceedings in a state court, as a railroad commission is not a court. Mississippi Railroad Commission vs. Illinois Central, 27 Sup. Ct. Rep. 90.

Inspection of rolling stock.—In a case of injuries to an employee caused by the breaking of a brake rod from a hidden defect therein the rule is announced that the company was not liable if the defect was not discoverable by such an inspection as was customarily made by well regulated and prudently conducted railroads, and was of the only kind practicable or which could be made without seriously interfering with the operation of trains. Shankweiler vs. Baltimore & Ohio, 148 Fed. Rep. 195.

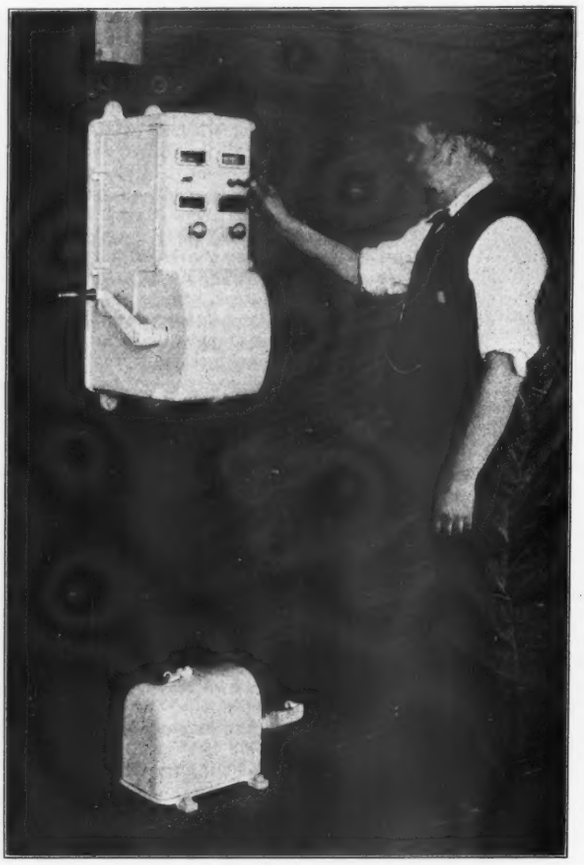
Construction of a foreclosure decree.—The decree and order of confirmation of sale in the foreclosure of a mortgage on the A., T. & S. F. Railroad required the purchasers or their assigns to pay, in addition to the price bid, any indebtedness and liabilities contracted or incurred by the owners in the operation of the road before it was thrown into the hands of the receivers, which were

prior in lien to the general mortgage foreclosed, on the court adjudging them prior in lien thereto. The court reserved jurisdiction for the purpose of adjusting such claims and gave the purchasers or their assigns the right to appear and defend against such claims and appeal from decisions thereon. Under this decree it was held that a claimant against the old company who had not secured payment out of the earnings of the road while in the hands of the receiver as provided in the interlocutory decree appointing the receiver could compel payment only by establishing on principles of equity that his claim was prior in lien to the mortgage as provided by the decree. Atchison, Topeka & Santa Fe vs. Osborn, 148 Fed. Rep. 606.

Foot Power Generator for Controlled Manual Block Station.

The accompanying illustration shows a controlled manual station block instrument in which energy for unlocking purposes is supplied by a foot power generator instead of by the batteries ordinarily employed. A number of advantages are claimed for the generator over the batteries usually employed.

With the batteries and the ordinary form of unlocking key it is possible for an operator to either leave or secure his key in the closed position, thus making it possible for the operator at an adjacent station to secure an unlock without asking for it. With the manually operated generator the operator, in giving an unlock, is required to impart motion to the generator, and this insures his co-operation in the act of giving a signal.



Foot Power Generator for Controlled Manual Block Station.

Where a continuous track circuit is employed between stations the current for the track circuit may be obtained from the same generator that furnishes power for unlocking, even though it may be necessary to employ several cut sections. With this arrangement no batteries have to be employed either in the station or out on the line. If desired, the generator can be wound to deliver alternating current for track circuit purposes, thus eliminating the possible effects of stray currents in holding up the track relays behind a train.

A manual generator by eliminating batteries removes all expense incident to their maintenance. The expense for the maintenance of a generator is practically nothing, and since the first cost of one will not be much in excess of the cost of a battery, plus its maintenance for one year, an abundance of power is obtained with a minimum of cost and trouble. With ordinary exertion a man can develop as much power as can be generated by from 200 to 250 batteries in prime condition. The apparatus is made by the General Railway Signal Company, Buffalo, N. Y.

The Early Use of Balanced Slide Valves.

At the December meeting of the Iowa Railway Club, Mr. W. F. Gould read a paper on balanced slide valves, in which he called attention to the early attempts at valve balancing that had been made on American locomotives. The first of these was a Grant engine built in 1864. This had a valve of the Moss type, and was very similar in construction to the Richardson valve of to-day; in fact, the only difference lay in the manner in which the corner pieces or strips were fitted into the corners of the valve to hold the packing at those points. The long packing strips were the same as in the Richardson valve, except that they were held up by spiral brass springs against the bottom of the steam chest cover, and the face of the valve did not travel over the valve seat as in the case wih these valves of the present day.

In those days there was no relief valve in the steam chest, therefore the engine would not drift at all, not even down a 2 per cent. grade. So these valves soon dropped out of sight and then the Adams valve appeared. This valve was made with a round ring or sleeve hollowed out in the center, and cast solid to the back of the valve. Into this sleeve was fitted a similar one, and it was made steam tight between the sleeves by means of a packing ring upon the periphery of the inside sleeve, while the top of the sleeve or ring was fitted against the bottom of the steam chest cover and was held up in position by means of a three-pronged spring. Each of the above described valves had small holes drilled through into the exhaust cavity, so that whatever steam should leak by either the packing bars or the ring would blow through into the exhaust, in the same manner as that of the Richardson valve of to-day, and still the engines would not drift until relief valves were put in. The area that was enclosed inside the ring on the Adams valve, or within the packing bars on the Moss valve, was all that was balanced on either of them, and there was always enough outside surface of the valve exposed to steam pressure to hold each end of the valve to the seat against port or cylinder pressure when the engine was working at full stroke. Therefore, after the exhaust had taken place, and before the opposite port opened, the actual relief to the valve was very slight, and yet the same conditions exist to-day with the Richardson valve. In those days, when the springs got weak, as they did sometimes, and the engine began to blow, we used to take up the steam chest covers and drive wooden plugs in the holes drilled into the exhaust, and very often it made the engine work better, but the balance features, of course, were lost. Therefore, in time the Adams valve was changed to what is known as the American balanced valve, which change consisted in making a shorter valve seat and changing the form of the packing ring only. So it can be seen the Moss valve was changed to the Richardson merely by shortening the valve seat and changing the form of the packing strips and putting in relief valves in the steam chest, so that the engines would drift, and not improving the balance one iota, for the reason that in no instance is any more pressure taken from the back of the valve than was taken from it when it was the Moss or the Adams of 1864. And it is in that respect just as imperfect now as it was then, and yet nine-tenths of the locomotives of to-day are using the Richardson valve because it is a slide valve and because piston valves for locomotives are a thing of the past. They were tried in 1862-3-4, and were thrown away the same as they are to-day, being supplanted by the slide valve.

Of course there are reasons for this, and one of them is that back pressure when the engine is running at a high rate of speed, is the most prolific cause of trouble with the piston valve.

There is another point to which I desire to call your attention, and I hope that some genius will, in the near future, see a way out of it, and that is the relief valve. I notice some of the recent forms of cylinders are equipped with devices for keeping the steam chest and cylinders hot with live steam, and yet they use the relief valve, a device which admits an unusual amount of cold air into the steam chest and the cylinders while the engine is drifting; therefore it cools off a steam chest or a cylinder or a steam pipe easier and quicker than any other way that I know of, and then many wonder why the steam pipe leaks.

In Prussia and Baden the railroads provide beds for trainmen whose service compels them to sleep away from home part of the time. Until recently the sheets and towels were changed at regular intervals of time, within which the sheets were usually slept on by two or more different men. Now they are changed with the men. Two sheets are issued to each man every two years and two towels every year, one of the sheets being long enough to cover the pillow. The employee cares for the washing and takes the articles with him if his service is changed, and becomes the owner finally.

Locomotive Superheaters.*

BY F. J. COLE.

The use of superheated steam on locomotives has progressed very rapidly in the last eight years, and at the present time about 1,600 engines are so equipped in Europe, and 260 in use or under contract in the United States, about 200 of these being in use on the Canadian Pacific Railway. It is interesting, however, to note that 58 years ago locomotives were built with superheaters.

One of the earliest records on file is of six locomotives built by the firm of John Cockerill, of Seraing, Belgium, in 1848, which are quaintly described as "having boilers 9 ft. long," and in order to obtain great heating surface the space around the smokestack was utilized, which had hitherto not been used.

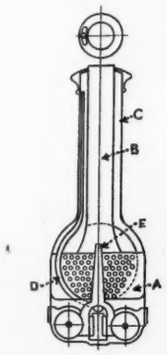


Fig. 1.

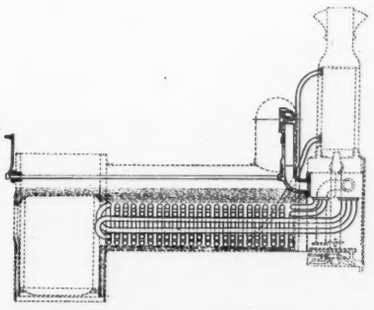


Fig 2.

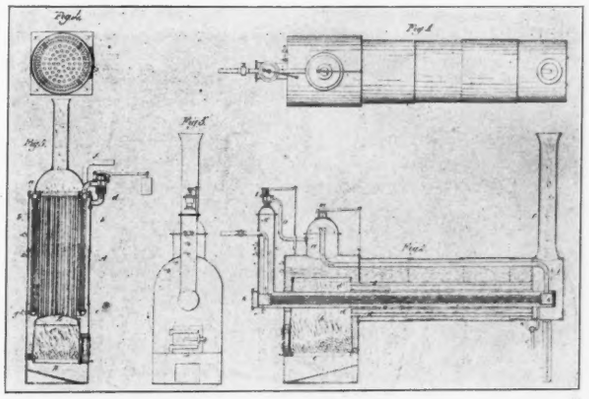


Fig. 3.

This arrangement is shown in Fig. 1, in which A is the smoke chamber, B is the stack, C is the steam dome which surrounds the stack to the upper point, D is the steam pipe which leads from the upper section of the steam dome to the steam chest, which is provided with the usual slide valves; E is the exhaust pipe for both cylinders. To prevent the cooling down of the smokebox, as also the outer side of the stack, there was provided a packing of felt and wood. The smoke chamber, A, is separated from the space F by means of a flat plate or deck extending over the uppermost row of tubes, with space F communicates part of the way with the cylindrical boiler and part of the way with steam dome C. The smoke chamber plate or deck is provided only with two openings, one of which is for the passage of the stack B, and the other for the steam pipe D.

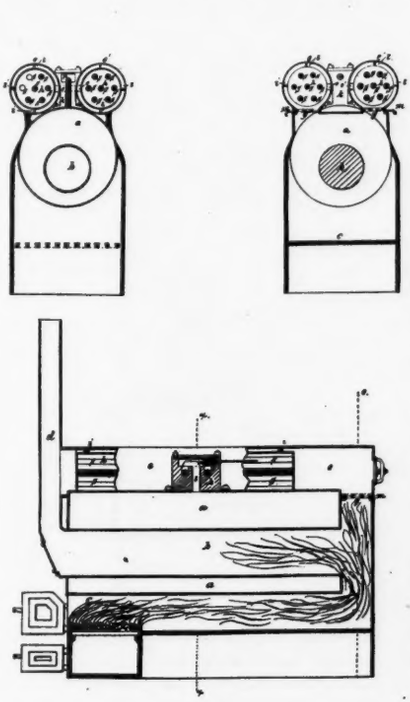


Fig. 4.

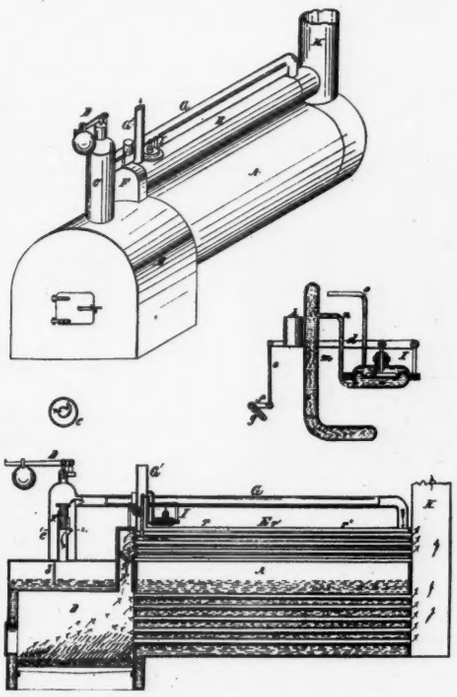


Fig. 5.

*A paper read before the Central Railway Club.

The description states that "this arrangement has demonstrated that by the generation of steam, due to the high steam pipe, the steam entered the cylinder entirely dry."

As recorded by Consul Mason, the experiments of Hirn, the Alsatian engineer, in the year 1850 were successful and superheaters were constructed of cast-iron, but the fact that the power of the superheated steam increased with its temperature had not been scientifically proven, and as the parts of the machine coming in contact with the steam were found to suffer when the temperature of 260 deg. C. was passed, no higher temperatures were attained, and it was left for Herr Schmidt, of Wilhelmshohe, to demonstrate that highly superheated steam at 300 deg. and 350 deg. C. materially reduced the amount of steam required, and that it could be used without danger to properly constructed machinery.

A superheater constructed in 1855 by P. J. C. Montety, of Toulon, France, is shown in Fig. 2, which illustrates one of the earliest attempts to apply a scientifically constructed apparatus to locomotives for the superheating of steam. In this the lower part of the boiler is occupied by an internal flue of large diameter, in which the pipes, both for saturated and superheated steam, are run lengthwise and coiled around the outer inside diameter of the large flue, their ends being upwards and terminating in steam boxes in the smoke box. The claims made for this apparatus at the time it was published are:

1st—The general construction and arrangement of apparatus for drying and dilating or superheating steam.

2d—The system or mode of superheating or dilating steam before it enters the cylinders by first drying it in a coil or coils of drying pipes and subsequently superheating or dilating it in a coil or coils of pipes placed in immediate contact with the flames issuing from the furnace.

A patent issued to W. M. Storm in 1857 (Fig. 3), illustrates one of the earlier forms of superheating apparatus applied to locomotive boilers. It consists of an internal flue of comparatively large diameter, with one end terminating in the smoke box and the other end extending entirely through the fire box and protruding outside the back head. A number of superheating pipes are located in this flue and provided with suitable headers for the saturated and superheated steam. The claim for this invention was substantially that of rendering steam to the cylinders without the exposure of the tubes or drying vessel to the direct action of the fire or hot products of combustion. Evidently this was an attempt to make an apparatus which would not rapidly deteriorate by the direct action of the flames, and would have a longer life than superheaters previously constructed which were subject to the direct action of the flame.

A peculiar arrangement patented by O. Newton in 1858 is shown in Fig. 4, in which the superheaters are placed at either side of the top of the boiler. The claim for this device was for producing a more perfect calorification and expansion of the steam after it leaves the prime steam generator and before it enters the cylinders of the steam engine by means of two or more steam chambers constructed,

as described, separate from the boiler and heated by hot air from the furnace, the steam thus anhydrated passing to the cylinder of the engine from one of these separate chambers while the steam in the other chamber is being prepared for the next stroke of the engine.

An illustration of a superheater by Stillman & Wilcox, patented in 1859, is shown in Fig. 5. It is placed on the top of the boiler with a large flue extending lengthwise and containing a number of small superheating pipes. This is supplied by hot gases directly from the furnace, the flow of which is controlled by an automatic damper in the uptake. The claim made for this device is that it regulated the flow of the products of combustion to the superheater by the differences in pressure between the superheated steam and that of saturated steam.

In 1860 J. Martin invented the device for superheating shown in

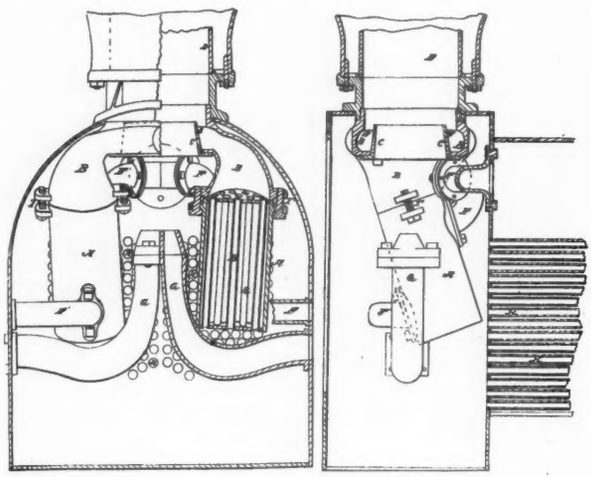


Fig. 6.

Fig. 6. This is located in the smoke box and is described as follows:

The strong draft through the chimney made by the exhaust will cause a vacuum to be formed in the annular chamber S, the filling of which vacuum will cause a strong draft through the flues R, of the chambers A and the pipes B B.

The claims are: First, the combination and arrangement of the flues R with the steam chambers A.

Second, the annular chamber S, in combination with the steam chambers A, flues R, and pipes B.

In 1863 Benjamin Crawford invented the smoke box superheater shown in Fig. 7, which consists of partitioning off the forward part of the boiler for the purpose of superheating steam. The circulation among the heating pipes is produced by the vertical diaphragm.

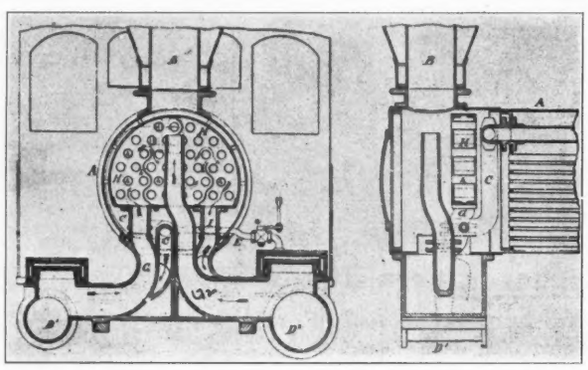


Fig. 8.

Another form of smoke box superheater is shown in Fig. 8. Mr. William S. Hudson, Superintendent of the Rogers Locomotive Works, of Patterson, N. J., patented this device in 1872. He described his invention as follows:

1. The superheating vessel H, in the form of a broadly extended diaphragm, perforated by tubes *h* and provided with one or more partial partitions h^1.

2. The arrangement, in the smoke box of a locomotive, of a drying and superheating vessel, with connections to the two cylinders, the whole so operated that the live steam shall be received from the boiler into one cylinder and exhausted therefrom into the other cylinder through the said superheater.

3. A locomotive having a secondary live steam pipe E, leading to the second cylinder D^2 and controlling valve *e*, with means of operating from the footboard, in combination with the main steam pipe C, leading to the other cylinder D^1, and arranged for joint operation relatively to the boiler A and the means for exhausting from the one cylinder into the other and superheating.

Still another form of superheater patented by A. Estrade, in 1882, is shown in Fig. 9. It consists of a U-shaped apparatus placed in the upper part of the fire-box, directly exposed to the direct action of the flames.

An interesting conception is shown in Fig. 10. This was patented by J. B. Bossler and S. D. Stauffer in 1890, but it is safe to assume that no practical application has been made of this device.

About 1898 the Prussian State Railways became active in experiments with locomotive superheaters, using devices of Wilhelm

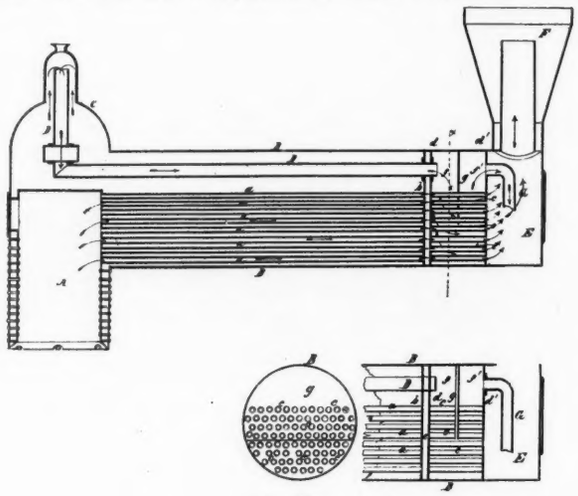


Fig. 7.

Schmidt, of Wilhelmshohe. Herr Schmidt had attained marked success in the use of superheating as applied to stationary practice, and by the assistance of and through the interest of Herr Garbe, of the Prussian State Railways, extensive experimental applications were made upon locomotives in Germany. The first two locomotive superheaters were applied in the year above mentioned upon the Prussian State Railways, and are still running. The first led to an extensive application, from which important experience has been gained. Herr Schmidt became the pioneer of the present development of superheating as applied to locomotives, much credit also being due to Herr Barbe for his bold and courageous indorsement of the principle. The earlier Schmidt superheaters take the form shown in Fig. 11, which shows a longitudinal view of the apparatus.

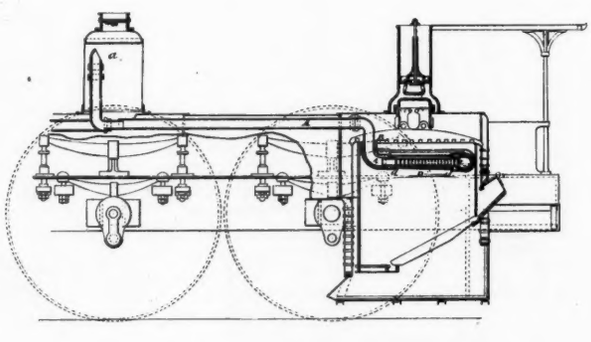


Fig. 9.

This consists of superheating pipes placed in the smoke box in the form of a horseshoe, the bottom part being bent around in semicircular form to conform to the shape of the longitudinal boiler flue of large diameter which delivers furnace gases of high temperature to the superheating tubes. The gases are forced to circulate around the superheating tubes by means of suitable diaphragm plates. After their temperature is sufficiently lowered they are discharged from the stack.

In 1901 a small Canadian Pacific locomotive was equipped with this apparatus, and its use has resulted in considerable economy in fuel and water. It is still in service.

In Germany there has been considerable competition between the Schmidt superheater just shown and another form, known as the Pielock, which consists of a chamber placed in the barrel of the

boiler between the fire box and the smoke box, through which the boiler flues pass, without break, from the fire box to the smoke box. They are expanded in the end walls of the superheating chamber in order to render them steam and watertight. While this device has some advantages, from a theoretical standpoint, on account of the high temperature of the gases at the superheating chamber, and that the temperature is afterwards reduced while passing through several feet of flues before being discharged into the smoke box, the expanding of the flues at some distance from their ends in the superheating chamber has been adversely criticized in this country and considered a serious objection to its use. One of the advantages, on the other hand, is the use of unobstructed flues, which renders them less liable to choke than the ordinary form of flue.

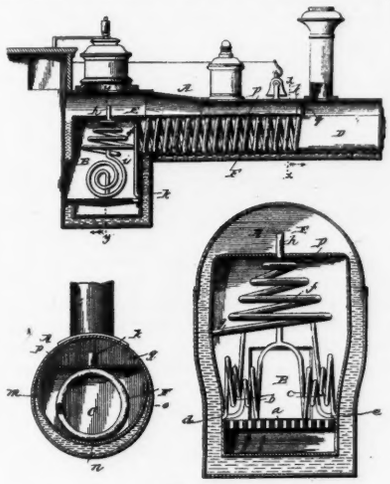


Fig. 10.

A locomotive built by the Egestorff Works, at Hanover, was equipped with this superheater and exhibited at the St. Louis World's Fair. It was a four-cylinder compound on the Von Borries principle. While the grate bars and draft arrangement were unsuitable for American coal and conditions, which rendered it impossible to obtain high horse-powers, yet the fuel and water economy was the lowest of all the engines tested, and in one instance the very low consumption of 16.6 lbs. of water per H. P. hour was obtained.

The later forms of Schmidt superheaters, as applied in this country, Canada, and to a large extent abroad, are of the fire tube type, as shown in Fig. 12. In this apparatus the usual boiler tubes are replaced in the upper part of the boiler by a number (in this instance 22) of 5-in. (outside diameter), flues. In each of these there are four U-shaped superheating tubes in pairs, extending back within about 3 ft. of the firebox, and connected at the front end to saturated and superheated steam tee headers.

In 1904 a New York Central Atlantic type engine was equipped with the original form of Schenectady superheater shown in Fig. 13. The upper part of the boiler in this apparatus was supplied with 55 3-in. (outside diameter) flues, in which superheating tubes of 1¾ in. outside diameter, and circulating tubes of $1^1/_{16}$ in. outside diameter were located. This locomotive is still in service. While considerable economy in water and fuel has been obtained by its use, yet the amount of superheat is not sufficiently high for the best results, and later types of superheaters made by the American Locomotive Company have been of the return bend system with larger fire tubes, allowing a much greater area for the passage of gases and reducing the liability to choke up.

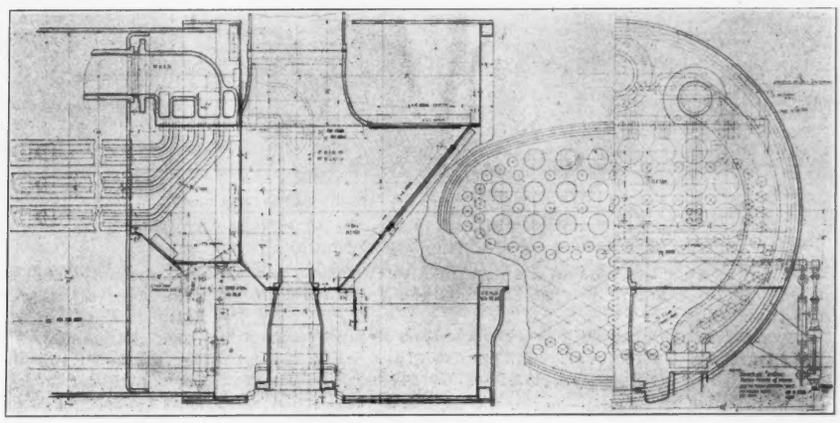


Fig. 12.

Owing to the restricted space for the passage of gases, the flues are more likely to clog up, and while good results are obtained when the flues are perfectly clear, yet as they gradually clog up, the decrease in superheat obtained is noticeable.

It is interesting to note, however, that with anthracite coal, this type of superheater has been very successful, and a locomotive running on one of the prominent Eastern lines (D., L. & W., No. 955) has been in successful use for over a year and has shown a marked degree of fuel economy. This is probably owing to the fact that no choking up or decrease of heating surface by coating over with soot takes place with hard coal. The picture of this anthracite coal engine equipped with superheater is shown in Fig. 14. Fig. 15 shows a later form of the American Locomotive Company's apparatus. The vertical headers are made detachable with independent bolting, so that any one may be removed for repairs without disturbing the rest of the apparatus. The connections to the tee head are made in the usual locomotive manner, viz., cast-iron ball joints, and all parts are designed to be as accessible and durable as possible. It

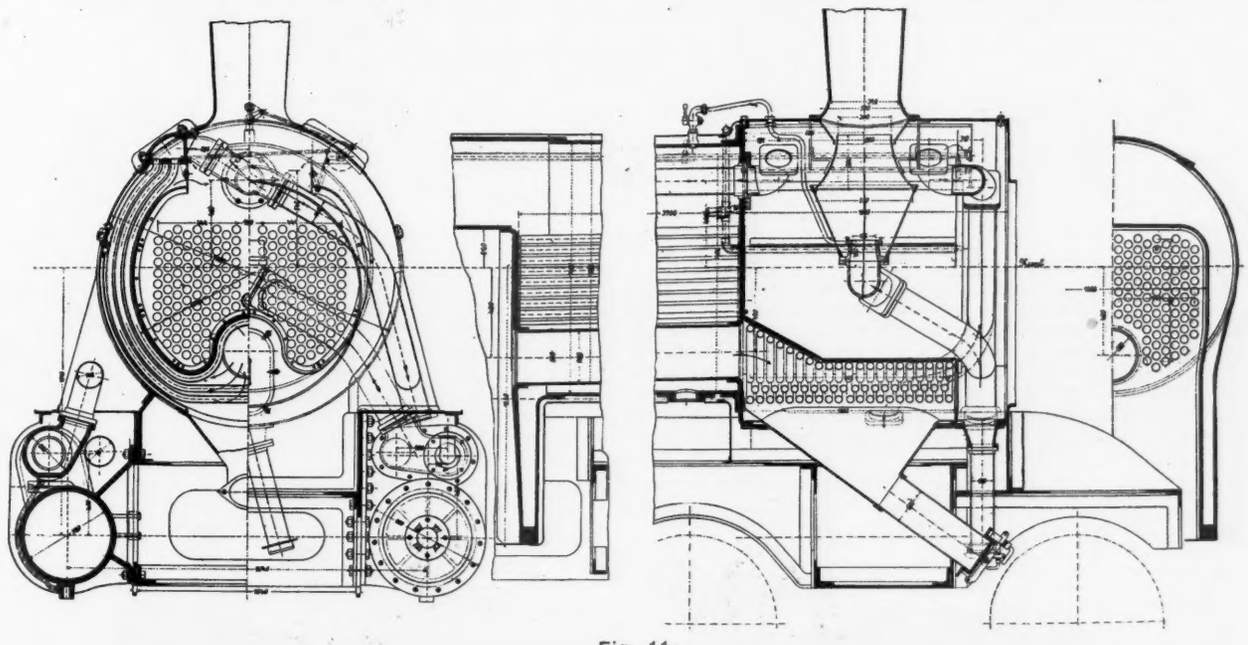


Fig. 11.

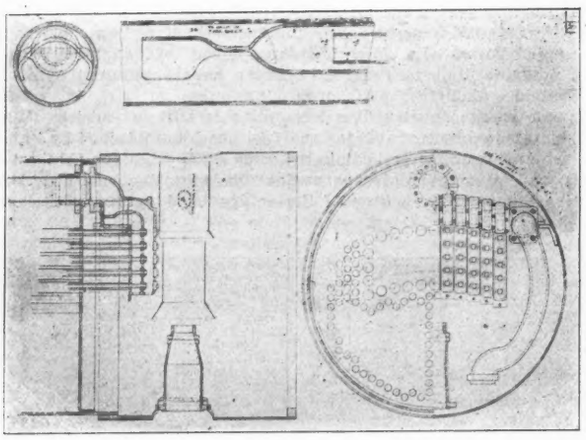


Fig. 13.

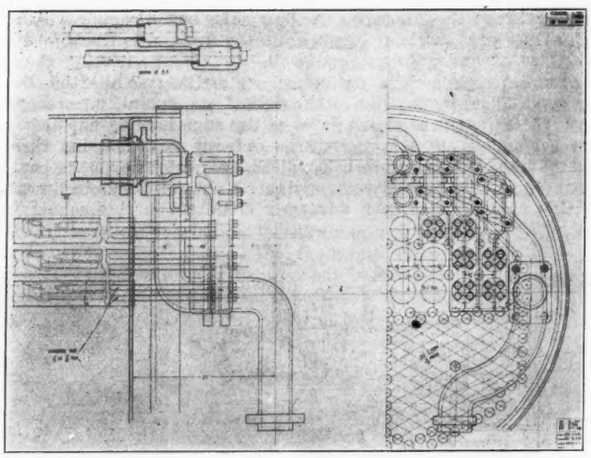


Fig. 15.

will be noticed that the headers are divided into two parts and the superheating tubes are in U-form, the ends being connected to different chambers.

Locomotives equipped with this general type of superheater are:

Northern Pacific.....462 Type, No. 310 (Fig. 16)
C. R. I. & P.....462 Type, No. 847
Boston & Maine.....460 Type, No. 346

A diagram of tests made on the latter engine is shown in Fig. 17, in a run from Greenfield to Boston, involving a 1.1 per cent. grade. The first line from the bottom shows the profile of the road; the second is the speed in miles per hour; the third is the position of the cut-off or reverse lever; the fourth is the position of throttle, either full or partly open; the fifth is the steam chest pressure; the sixth is the boiler pressure; the seventh is the temperature corresponding to the saturated steam at steam chest pressure; the eighth is the actual temperature of the superheated steam at the steam chest; the ninth is the smokebox temperature. The actual amount of superheat obtained at the steam chest is, therefore, given between the lines seven and eight, averaging for the entire run while working steam 114 deg., and reaching in some instances to about 150 deg. The observations were made every mile, so that the diagram gives a very close record of the fluctuations of temperature. The temperature characteristics of the entire run can be very readily observed by means of this diagram in a few moments. It is interesting to note that the excess of temperature between the superheated steam and that at the smokebox is comparatively small, the average probably not exceeding 110 deg. This engine has shown considerable economy in the use of fuel and water.

The superheater applied to the engine on which these tests were made is shown in Fig. 18. The tests of this engine and one of similar type, but using saturated steam, were made by the Boston & Maine Railroad, with the advice of Prof. Gaetano Lanza and several undergraduate students from the Massachusetts Institute of Technology. The water was measured by water meters, and checked by water glasses in each corner of the tank. Four indicators were used in getting cards, and Boyer speed recorder and Crosby revolution counter were used for indicating speed. The steam chest temperatures were taken by means of high-grade glass mercury ther-

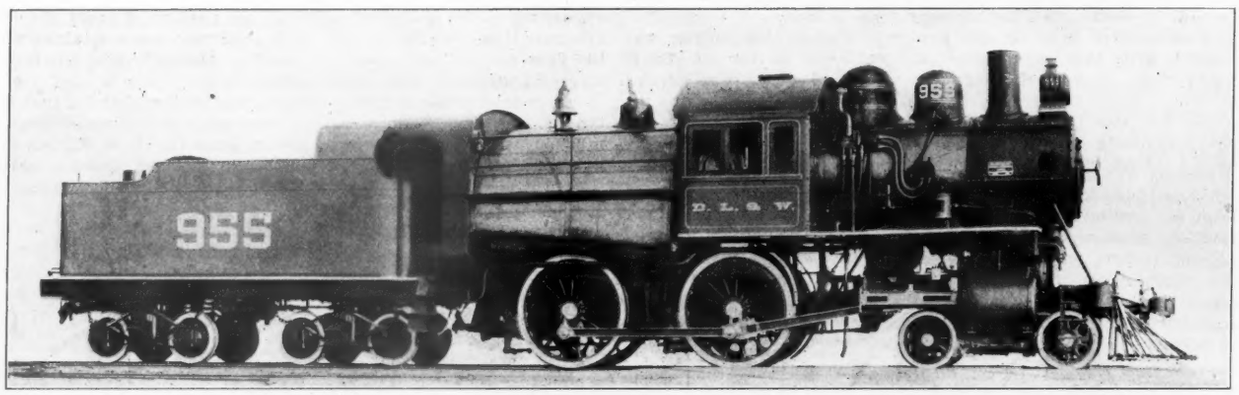


Fig. 14.

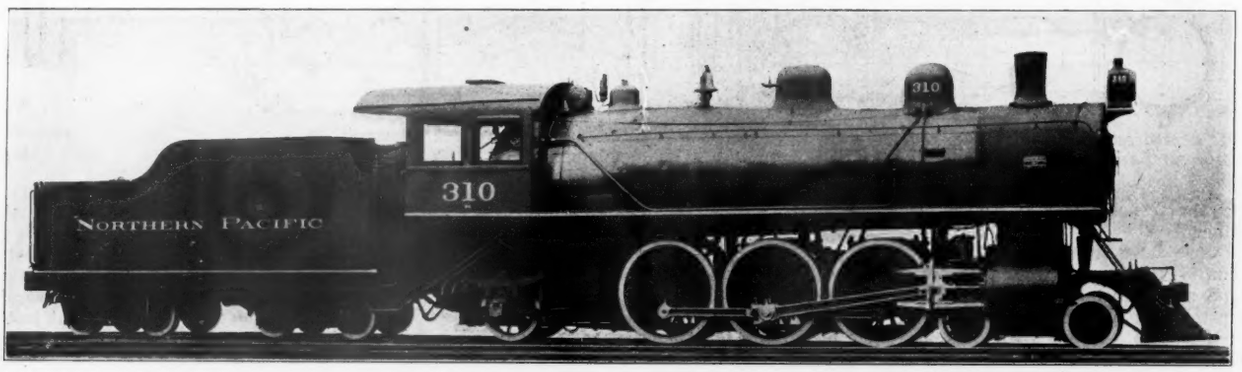


Fig. 16.

mometers inserted in the steam chest cavity. The amount of steam used by the air-pump was carefully considered, and the quality of the steam determined by means of a Peabody calorimeter. The amount of coal was determined by weighing some two or three tons placed on the tender, and the remainder contained in bags weighing 100 lbs. each. The tabulated summary of the tests is given in the accompanying table. It will be seen that the economy in coal, on the basis of ton miles, was 15.15 per cent.

SUMMARY OF TESTS ON B. & M. ENGINES, 1123 AND 1126, AUGUST 16, 17, 24 AND 25, 1906. BY AMERICAN LOCOMOTIVE COMPANY, ROGERS WORKS. October 29, 1906.

Line.	Item.	Superheated steam (Eng. 1126) Run 1.	2.	3.	4.	Summary Max.	Min.	Mean.	Saturated steam (Eng. 1123) Run 5.	6.	7.	8.	Summary Max.	Min.	Mean.	Gain, 1126, Pr ct.
1.	Direction of run	West	East	West	East	.....	.....	.....	West	East	West	East	.....	.....	.....	.....
2.	Number of cars	8	6	8	9	9	6	7.75	9	8	7	9	9	7	8.25	.....
3.	Tons behind tender	300	271.3	315.2	429.6	429.6	271.3	331.3	360.2	342.2	374	375	375	274	337.8	.....
4.	Ton-miles per run (105.6 miles)	32,630	28,649	33,285	45,365	45,365	28,649	34,985	38,037	36,130	28,934	39,610	39,610	28,934	35,672	.....
5.	Coal burned, lbs.	7,480	6,830	5,762	7,043	7,480	5,762	6,779	7,353	8,035	7,700	8,600	8,600	7,353	7,922	.....
6.	Water evap. (from and at 212°), lbs.	60,962	54,300	52,960	59,160	60,962	52,960	56,845	64,780	60,665	65,140	66,220	66,220	60,665	64,201	.....
7.	Water evap., per lb. of coal, lbs.	8.15	7.95	9.19	8.40	9.19	7.95	8.42	8.81	7.55	8.46	7.7	8.81	7.55	8.13	3.6
8.	Ton-miles, per lb. of coal	4.36	4.19	5.77	6.44	6.44	4.19	5.19	5.17	4.50	3.75	4.61	5.17	3.75	4.507	15.15
9.	Ton-miles per lb. water (from and at 212°)	.535	.528	.628	.767	.767	.528	.615	.587	.596	.444	.598	.598	.444	.556	10.49
10.	Smokebox temperature, average, deg. Fahr.	584	595	576	588	595	576	586	594	589	600	597	600	589	595	.....
11.	Superheat average while working, deg. F.	80	114	99	101	114	80	98.6	.....	.....	.....	.....	.....	.....	.....	.....
12.	Cutoff, per cent. of stroke, average	24	25	24	27	27	24	25	27	24	23	22	27	22	24	.....
13.	Throttle opening, per cent. of full opening	88	85	76	76	88	76	81.25	62	54	72	76	76	54	66	.....
14.	Per cent. of run with throttle open	69.7	81.8	76.2	74.5	81.8	69.7	77.55	78.6	78.1	85	82.8	85	78.1	81.1	.....

Another form of superheater which has been applied to a number of Canadian Pacific locomotives is a development by Messrs. Vaughan and Horsey, shown in Fig. 19. The reports from this apparatus are very satisfactory and high temperatures have been obtained. At the present time about 150 locomotives have been equipped, and in addition fifty are under contract for next year's delivery. This apparatus consists, as in the Schmidt and American Locomotive Company forms, of a number of large 5-in. tubes located in the upper part of the boiler, in which U-form superheating tubes connected to headers in the smoke box are arranged. The characteristics of this superheater, briefly, are, the use of two comb-like headers, with fingers cast integral, one located in the upper part of the smoke box for the saturated steam with the fingers extending downward, and the other just below the center of the smoke box for the superheated steam with the fingers extending upward, arranged in alternate rows for connection to the superheating tubes. The superheating tubes are connected by means of a cross to the front of the fingers and arranged in groups of four, each opening service four superheating tubes. A Canadian Pacific ten-wheel locomotive equipped with superheater is shown in Fig. 20.

The attitude of the Canadian Pacific Railway, and especially that of Mr. H. H. Vaughan, assistant to the vice-president of that road, toward the application of superheaters to locomotives has been praiseworthy, in that from the small beginning of one locomotive to which a superheater was applied by Mr. Roger Atkinson in 1901, this railway now has more locomotives equipped with superheaters than any other line on this continent. By this large scale application, the natural nursing which a small number of locomotives equipped with a special device would ordinarily receive has been entirely overcome and the question of superheating has been placed directly upon its merits, the number of applications being so great as to prevent specially careful treatment of individual locomotives. This attitude required considerable courage, but the results appear to fully demonstrate the wisdom of the course pursued. With over 200 locomotives now equipped with different forms of superheaters, an opinion has been formed which is of great value in establishing the superheater as a fixture in locomotive practice.

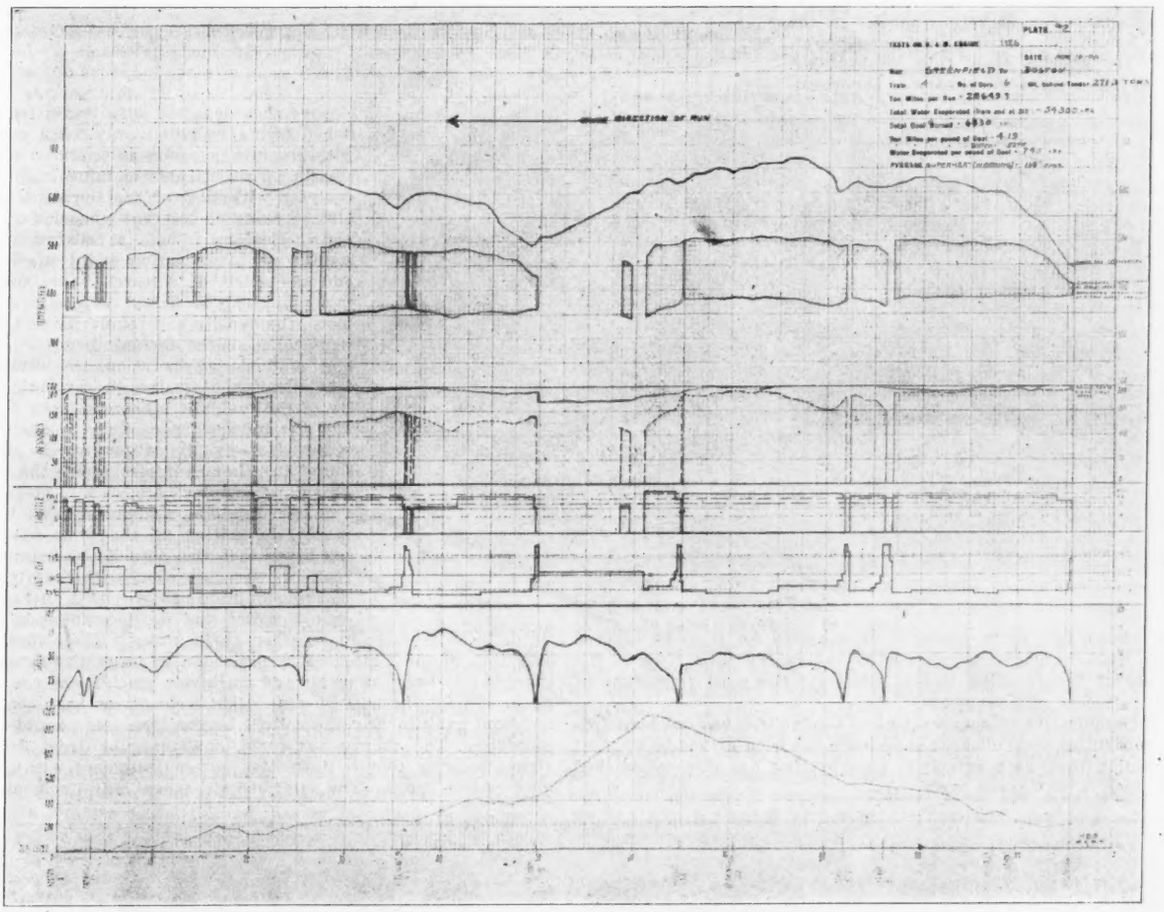


Fig. 17.

It is not to be expected that so important a principle as super-

heating, which has undergone a development in this country in so short a period as five years, would be perfect, but it may certainly be said from facts of experience that superheating, as a principle, has demonstrated its value and established itself as a subject for the best thought and most careful consideration of locomotive designers.

The superheater presents the possibility of economy in fuel, increased capacity for steam-making of any given boiler and an increased cylinder capacity, because of the absence of moisture in the steam. Among the other advantages offered by superheating is an important one in connection with the question of boiler pressure. Not only many locomotives with rather small boilers be considerably improved in steam-making ability, but pressures may actually be reduced in connection with superheating, to a limited extent, without noticeable loss of power. In operation it has been noticed that the boiler pressure of a locomotive using superheated steam may vary within wide limits during a run without such decrease of speed as would follow the same fluctuations in pressure in a locomotive using saturated steam. This becomes rather important from an operating standpoint.

Viewed as a question of economy, the superheater renders it possible to continue the use of old locomotives, which, without the application of superheaters, would be considered out of date, and when applied to the largest and most modern of passenger locomotives, the economy in fuel and steam appears in connection with the capacity of the fireman to produce the necessary horse-power.

In his papers upon this subject Mr. Vaughan has covered the theory of superheating so thoroughly as to render it unnecessary for it to be covered again. This discussion is intended to review the chief steps in the progress of superheating and to illustrate the most important of the more recent improvements.

The application of superheating to locomotives has not been free from difficulties, but sufficient experience has been gained to warrant the opinion that, as a principle, superheating has now established itself upon a permanent basis.

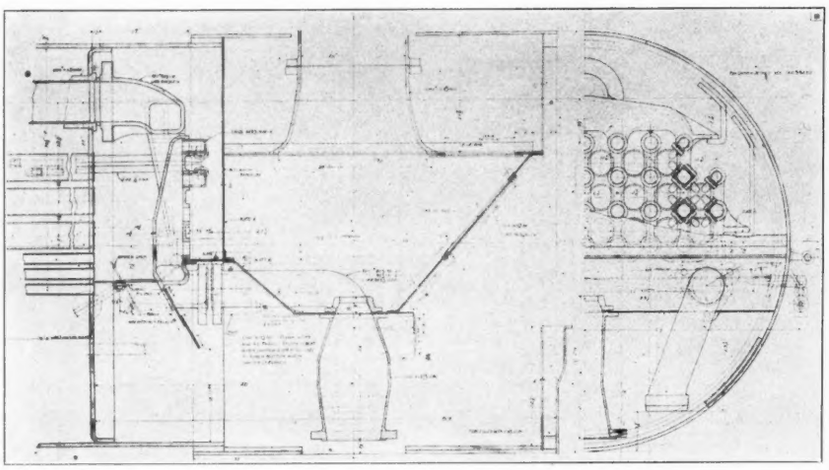


Fig. 19.

National Characteristics in Locomotive Building.

II.

[The critical reader of these extracts from Maurice Demoulin's interesting comparisons should bear in mind that his book was written probably as long as two years ago. In several casual statements, such as: "Great Britain has almost entirely rebuilt its motive power equipment within the last four or five years," the writer has been misinformed; but, taken as a whole, his comparisons are interesting and valuable.]

Great Britain.—Higher powered locomotives have been built in England during the last few years, but the designers have gone slowly; they departed with regret from established forms, and that only when confronted with absolute necessity and assured of certain results. This attitude of mind is in striking contrast with that of the Germans, who are always ready to test new theories on a large scale. England is not, in railroad matters, a country of investigation and test. Ingenuity and the spirit of research have been voluntarily limited to actual necessity. Furthermore, the density and regularity of traffic, the importance of the receipts per mile, the general methods of operation, the division and specialization of trains, the exceptional quality of the fuel, the high axle loads permitted, and the independence of the companies have removed many difficulties which are to be found in other countries where the problems are more complex.

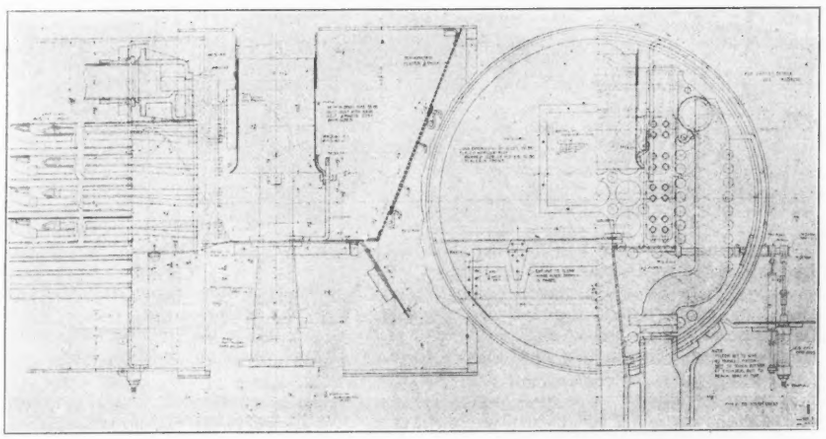


Fig. 18.

The English companies have been successful in getting all the work out of their machines that was possible by using the best fuel. It was only when with the highest rate of consumption they could not generate enough power that the locomotive builders decided, inch by inch, to lengthen their grates. Their idea has not been that of the United States, to make as large an engine as possible, but to build as small and as light a machine as could do the work. So for the past 20 years light locomotives have remained in the front rank in England a little longer than was possible in other countries. The change has come, however, and Great Britain has almost entirely rebuilt its motive power equipment within the last four or five years. The intermediate types, built from about 1896

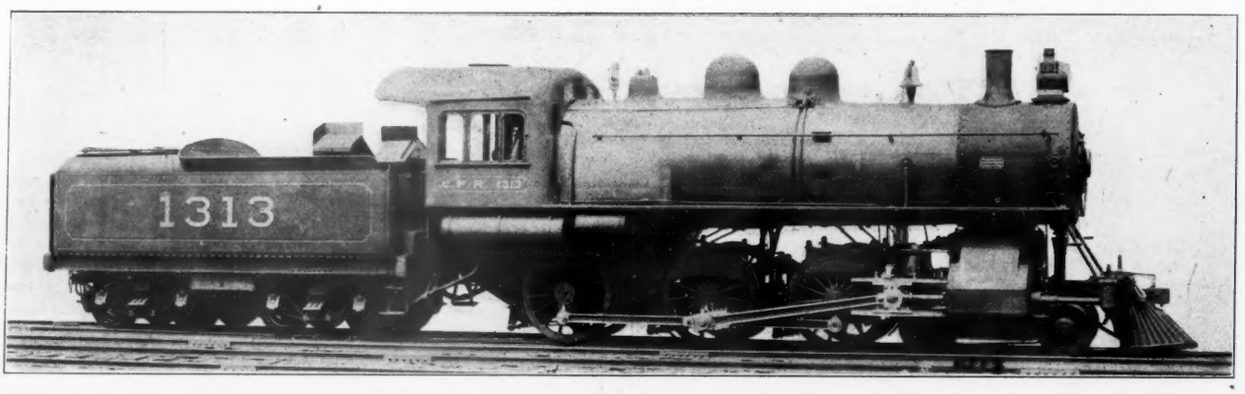


Fig. 20.

to 1900, were steps in the transition from the then established forms to the present machines, which, breaking away from traditions believed to be immutable, have enough tractive power to haul most of the heavy trains, especially on the lines in the north and west. Many of the new types of locomotives are as powerful as the prevailing types recently built on the continent, judging from their heating surface and grate area. Taking into account the superior quality of fuel, the rate of combustion which they normally attain, and their tractive adhesion, we find that they are even more powerful than the continental engines. There are some points which should not be lost sight of in considering these English machines and comparing them with those of other countries. They may be classed a little apart and justify the generally used ratio of greater heating surface and weight to grate area.

Irish locomotives have the same general arrangements as those of Great Britain, although they are less powerful, in spite of the broad gage of the track. In the British colonies we also find the same types, but they usually have more axles because of the lower axle load allowed; the diameter of the wheels, also, is less. Excepting in India, American influence is generally in evidence; Consolidation and Prairie types are frequently met with, especially on narrow gage lines.

The railroads in the north of England no longer have a monopoly in speed. The French lines to-day rival and even exceed them on certain runs. Nevertheless, England will for a long time continue to be a country of many and frequent express trains of all classes. The density of population, the number of great industrial centers and the national character explain a situation not found in any other country. The speeds attained in regular service are as high as 60 miles per hour, and at least one regular run is made at the rate of 62 miles per hour; this is on the Great Central from Aylesbury Road to Sheffield, about 125 miles. There are at least 52 runs where the schedule speed is more than 54 miles per hour over distances varying from 30 to 250 miles.

Probably the most remarkable service in England is on the line from London to Plymouth, 240 miles. On that portion from Newton-Abbot to Plymouth, 32 miles, there are grades of from 1½ to 2 per cent., and there is another part, 50 miles long, with grades of from 0.8 to 1.2 per cent. The whole run is made without stop in 4 hours 22 minutes, while the distance from London to Newton-Abbot, 208 miles, is covered in 3 hours and 42 minutes, or at an average speed of over 56 miles per hour. The average train load is 200 tons.

Perhaps because of an unfortunate early experience, England has for the past 10 or 12 years stood out most obstinately against compounding, although the idea was largely formed and developed in her marine engines. It may be said that even to-day there is not a single compound locomotive in England which is not a trial machine. This condition is due to circumstances which it would take too long to discuss in this place; most English motive power men seem to fear the complication of the four-cylinder compound engines and are not yet quite convinced that they really pay for themselves in the economy or increase of power which is credited to them. The three-cylinder engines of the London & North Western, a defective type, have long since been broken up or relegated to passenger service, and are now only used on express trains or as pilots. The Worsdell engines of the Great Eastern and of the North-Eastern have been changed to single-expansion machines.

It is proper to state here that the introduction of the compound in England has not been accompanied by so radical a transformation of the locomotive as it has in France. Certain characteristics of the French compound locomotives belong, in a way, to the English type, but have not, in the latter case, been so much improved. However that may be, the remarkable results obtained with French compound locomotives have attracted the attention of the English companies and the time is not far distant when the four-cylinder type, more or less modified, will be extensively used in England. The London & North Western has a few engines of the Webb four-cylinder type dating from 1900. Since 1903 the Great Western has put in service three Atlantic type, four-cylinder compounds, built at Belfort; one is of the type used on the Nord of France and the other two are like those on the Paris-Orleans, somewhat modified in their external appearance. The Great Northern has just built two interesting four-cylinder compounds. It would appear for the moment that the future of the system in England depends on the results obtained with these five machines in comparison with simple locomotives on the same lines. In any case the question is still open and the English, like the Americans, seem rather disposed to look to the superheater for a solution.

The English machines, without losing their characteristic symmetry and simplicity, have, nevertheless, of late years, undergone important modifications because of the large increase in the power of the boilers and the introduction of American and continental details, often modified to fit local ideas and tendencies. Thus we have seen the gradual introduction of the Belpaire firebox, which is used more or less generally in new engines on such important lines as the Great Western, the Midland, the Great Central and the Great Eastern, though it seems, on the whole, to be actually losing favor; smokeboxes which are quite long, though not really of the extended type; outside cylinders and even, though this is exceptional, four cylinders, of which two are inside. Finally, attention must be called to the appearance, on some recent engines, of the Walschaert valve gear.

English locomotives are somewhat massive and their weight, compared with grate area, is usually greater than that of continental engines. Nevertheless the power produced per square foot of grate area being higher than that obtained elsewhere and the fuel being almost entirely lump coal of a superior quality, the weight per horsepower is certainly no greater. On the other hand, the limit of weight per axle is generally placed at about 20 tons, so the English builders have not been forced to pay the same attention to the reduction of weight as the continental builders.

The English fireboxes are of the Belpaire or Crampton types. The first of these, after having enjoyed a somewhat extensive popularity, seems likely, as noted above, to be less generally used, if not entirely abandoned, in the future. Fireboxes are always placed above the axle, and are shallower than on the continental engines, while certain Atlantic type engines, notably on the Lancashire & Yorkshire and the North-Eastern, have a large grate area whereby combustion can be made complete. The Great Western has within recent years adopted a boiler without a dome but with a wagon top firebox. The tubes are always smooth and are of steel or brass. Grates are cast-iron without a drop.

The smokeboxes are parallelopipedons, which are successful in stopping sparks and are still extensively used, being found in machines of the most recent construction. The stacks are quite short on account of the height of the engines and the clearance on many of the lines, which limits the height above the rail to from 13 ft. to 13 ft. 6 in. They are usually surmounted by a brass or red copper cap.

The safety valves are always loaded direct, and twin valves, the Webb or Ramsbottom, are being less and less used. They are never placed on the dome but always on the roof sheet over the firebox. Boilers are only fastened to the frame at the smokebox and with supports and expansion plates at the firebox. We know of no English locomotive which has any intermediate support to the boiler. The height of the center of the shell of boilers recently built varies from 8 ft. 6 in. to 9 ft.

The smokebox doors are round, and there is often more than one central opening; many recent engines have several bolted doors placed around the circumference. The exhaust is always fixed and the pipe is set at the height of the center of the boiler. Outside frames have been abandoned, although the Great Western has a number of comparatively recent machines of this type. The frames are strongly braced. Cast-steel is generally used for all accessory pieces and exclusively for wheel centers.

Relying on the excellence of their roadbed, English builders seldom fit their locomotives with equalizing bars, so that the engines, especially the types where no truck is used, and even those of the Atlantic type, which are heavily loaded at the center, have a tendency, when running at high speed, to gallop. Axles are forged and are frequently built-up. The Adams bogie is less used than formerly, and we now find on many of the latest engines the swing link type by which the weight is returned to the central position by gravity. The wheel base of the bogies has been made rather short and rarely exceeds 6 ft. 6 in.

Inside cylinders are still extensively used, even where the diameter is as much as 21 in. for simple expansion engines. The valves are ordinarily placed above the cylinders, but sometimes, when the cylinders are outside, the valves are below. When the valve motion is between the frames the valves are above the cylinders and are operated by an intermediate rocking shaft. Recently they began to use the Walschaert valve gear; only, however, on four-cylinder simple or compound engines. Piston valves are used mostly, but we find also a number of balanced valves and even some with the exhaust through the back.

Interchangeability is still an end always sought for in the motive power departments, and new types are often worked out with the idea of using the mechanism of previous types. Running boards are straight and rather low. The cabs have been changed somewhat within the past few years because of the great height of the engine, which now fill about all of the clearance allowed, so that even the upper corners have to be rounded. Care is taken to get that symmetry and regularity that is of such prime importance to the English. The painting is carefully done and maintained, especially on express locomotives.

All tenders are of the six-wheeled bogie type; yet, because of the number of water tanks and Ramsbottom scoops their water capacity is not proportioned to the length of the runs, which are sometimes as much as 200 miles without a stop.

Belgium.—The motive power on Belgian roads has gone through greater changes during the past 20 years than in any other country. The first decade of this period saw the general use of outside frames and the wide firebox in a Belpaire boiler, which

gave grate area of about 54 sq. ft.; this allowed the burning of fine coal. Starting from this date, a complete reaction set in, leading to the introduction of the pure Scotch types, with inside frames and cylinders and a narrow and deep firebox; these engines were widely used elsewhere and gave excellent service. They were designed to burn briquettes. Later the necessities of the service led to the production of new types with four and six wheels coupled and to the introduction of the superheater; among these engines were Atlantic type locomotives, some of which were shown at the Liege Exposition. All of them had comparatively shallow fireboxes with inclined grates, fitted with a short brick arch and adapted to either a mixture of fine coal and briquettes or briquettes only. The deep firebox, however, is still applied to high-speed express locomotives.

It is hard to be sure of the end toward which even well marked characteristics in design are tending. They may be either experimental or the results of long development. The recent exposition at Liege, however, where some new and interesting models were shown, enables us to review the principal types of Belgian locomotives. These engines showed careful workmanship and presented a fine appearance, though a trifle massive; they were compact and powerful. An examination shows that the Belpaire firebox and outside frames, that were for so long characteristic features of the Belgian locomotives, have now been abandoned. All the recent boilers are of the Crampton type with the crown stayed with vertical stays; the shell is set high to get enough depth for the firebox, which, however, is always above at least one of the coupled axles; they are of the narrow type dropping down between the frames. The smoke-boxes extend to the front in the English manner; the tubes are smooth; the safety valves take the load direct and are immediately above the firebox. The stacks are very short on account of the great height of the shell, which rises to 9 ft. 2 in. above the rail in some recent engines; the stack is usually surmounted with a polished brass cap. The cylinders are usually on the inside, but there are some on the outside on the four-cylinder trial machines. The mechanism is heavy and massive and the cranks are hollow. The six-coupled types with wheel of moderate diameter are becoming more and more predominant, for passenger service; a perfectly rational development in a small country with a dense population, where trains are run at frequent intervals and on lines where it is rarely possible to maintain high speed for long distances. As a matter of fact, the longest express run in Belgium is only 75 miles.

United States.—The necessity for rapid production to meet the increasing demands of the enormous railroad systems of the country has left American locomotive builders no leisure for the study of the minutiae of certain details of construction, which might be useful in reducing weight and improving the operation of their engines. The locomotives in use in the United States present a most interesting subject for study, especially in their increasing power, which is becoming more and more characteristic of them. American builders recognize to-day that they can well borrow certain details from European practice. No one denies American engineers credit for the initiative they have taken in introducing the high-speed four-coupled engine with the bogie in front, known as the Atlantic type, and making general the use of trucks with two or four wheels under most types of engines. They were the first to break away from the fictitious limitations set on locomotive development by raising the boiler higher than would have been thought possible in Europe; a simple measure that allowed the machine to grow to proportions unforeseen 20 years ago.

The American high-speed locomotive, as it is now built, has a grate area of from 48 sq. ft. to 64 sq. ft., and a heating surface of from 2,700 to 3,800 sq. ft.; it weighs, in working order, from 75 to 105 gross tons, of which from 46 to 75 tons are upon the driving wheels, and it can haul over an undulating track of ordinary easy grades a train weighing 200 gross tons at a speed of 50 miles an hour. Recent freight engines have from 43 sq. ft. to 60 sq. ft. of grate area and weigh from 90 to 110 gross tons. For roads whose tracks can carry the weight they have built engines weighing 125 gross tons, with a heating surface of 4,800 sq. ft., while an exceptionally heavy Mallet articulated locomotive built for the Baltimore & Ohio has 5,600 sq. ft. of heating surface. This remarkable increase in the grate areas cannot be attributed directly to the use of inferior fuel, for locomotives burning a good quality of bituminous coal frequently have a grate area of from 48 to 54 sq. ft. Freight locomotives of the later types haul as heavy loads over steep grades as the mogul locomotives in use a dozen years ago could haul on a level.

The usual axle load allowed varies from 22 to 23 gross tons, while in some cases it is put at 26 tons. The axis of the boiler of a high-speed engine is often 9 ft. 6 in. above the rail on engines having drivers from 70 in. to 80 in. in diameter, while the diameter of the shell itself on engines of recent design is rarely less than 70 in., and is often as much as 80 in.

The practice which has dominated the whole transformation of American locomotive design during the past ten years, and which was the initial cause of the development, is the application of a firebox allowing grates of more than 35 sq. ft. area, and which, being almost cubical, seems not to suffer as much from variable expansion as the narrow fireboxes that are deep and long. To use this form of firebox it is necessary to raise the axis of the boiler so that the foundation ring may be placed above the rear wheels. When the coupled wheels do not have a diameter of more than 63 in., the firebox can be placed above them and still be deep enough, without raising the axis of the boiler to more than 9 ft. 6 in. above the rail. When the wheels have greater diameters, this cannot be done and the firebox is set behind the coupled wheels and is carried direct by trailing wheels that are usually about 48 in. in diameter. This arrangement obtains in the recently developed Atlantic type.

General Conclusions.—The evident tendencies which have become more and more firmly established in European practice may be summed up as follows:

1. The increasing and possible general use of a wide firebox with from 38 sq. ft. to 48 sq. ft. area, having wide water legs, being either of the Belpaire or corrugated flue type and widened as much as possible, in combination with a wagon-top boiler, which seems to be an interesting, if not indispensable, complement.

2. The return to smooth tubes for long shells. The adoption of heating surfaces proportioned to the grate area ranging from 3,000 sq. ft. up.

3. The gradual increase of the adhesive weight, either by increasing that allowed on each axle, when possible, or by increasing the number of coupled wheels. Engines for fast trains with six wheels coupled will probably come more extensively into use, at least until it is possible to use Atlantic type locomotives with an adhesive weight of at least 40 tons.

4. The conditions prevailing in Europe in the matter of fast trains involves the use of the Pacific or the prairie types by which the use of six-coupled wheels is reconciled to that of the wide firebox. The Atlantic type, if it is still built a few years hence, will necessarily need the wide firebox, for the possibility of the use of the latter constitutes the principal advantage of this type of machine. The consolidation locomotive seems to have filled for some time to the requirements of freight service, but it is quite possible that the application of the wide, or at least a widened firebox, with a corresponding elevation of the shell, may become more frequent on this type of machine. For suburban service, the six-coupled type with the driving wheels set between two Bissel or four-wheeled bogies seems to be becoming popular. We can also see, in the six-coupled type, with a two-wheeled pony truck in front and a four or six-wheeled bogie behind, one of the types of the future. If the diameter of the driving wheels is kept at 63 in., it is quite easy to use a wide firebox on this type of engine, although it is less necessary than on the other types.

5. It is also quite possible to foretell the extended use of engines with four cylinders, driving four cranks placed either on the same or on different axles, the wheels on which are coupled. It is to be expected that such machines will usually be compounds, in spite of the tendency on the part of some builders to use the four cylinders on simple expansion engines. The use of this latter type can only be extended by applying superheaters, and it is on the recognition of this fact in practice that some of the promoters of the type depend. We see a general increase in the ratio between the high and low-pressure cylinders of compound locomotives. Finally, powerful and perfect as the locomotive of to-day may be, it can only be considered as marking a stage in the evolution of the machine, the end of which it is easy to foresee.

Foreign Railroad Notes.

The Krupp works have some cars with two eight-wheeled trucks for carrying heavy guns which are able to carry a load of 198,000 lbs. each. The railroads haul these cars only to four fortified forts on the North sea and the Baltic and to the Krupp proving grounds, the great car being between two or more empties, if in a regular freight train.

In its fiscal year ending with March, 1905, 198 miles were added to the Japanese railroad system, making the total 4,694 miles, which had cost on the average $41,913 per mile. The train movement for the year had been at the rate of 10 trains each way daily, the passenger car movement to 59 and the freight car movement to 95 freight cars each way daily, and the average number of cars per train was 15.4. The movement of passengers was equivalent to 777 each way daily; of freight, to 617 tons each way daily—a very considerable business. The average passenger journey was 21 miles; the average freight haul, 95 miles. The average receipt was 0.7 cent per passenger-mile and 0.8 cent per ton-mile. The earnings averaged $6,440 gross and $3,530 net per mile. The average earnings per train-mile were 86 cents gross and 47 net, and the net earnings were 8.3 per cent. on the cost of the railroads. The number of employees was 14.2 per mile of road. The railroad from Tokio to Yokohama, 404 miles, earned $24,477 gross and $7,992 net per mile, the latter being 18 per cent. on its cost.

GENERAL NEWS SECTION

NOTES.

The Atchison is reported to have re-established a $2 charge for reconsigning grain in Chicago.

It is announced that the Pennsylvania Railroad has raised the age limit at which it will employ men in any capacity from 35 to 45 years.

It is reported that the New Haven road will commence operation of its all-water service between New York and Boston late this spring.

It is said that the Trunk Lines have agreed on an advance of 10 per cent. on bituminous coal and other heavy commodities, effective April 1.

On February 1 the Boston & Maine made a reduction of from 15 to 25 per cent. in its passenger fares. On the Fitchburg division the new rate is 2 cents a mile.

Fourteen clerks of the Pennsylvania Railroad, employed at the Broad Street Station, have been dismissed because they borrowed money at usurious rates of interest.

The Indiana Senate passed the Bland Bill January 31, which provides for two-cent railroad fares in Indiana, with no excess charge for failure to purchase tickets.

In testimony before Interstate Commerce Commissioner Lane, at Seattle, Wash., January 24, the Northern Pacific stated that it had reached the limit of its carrying capacity as a single track line.

It is reported that the pay car has been abolished on the St. Louis, Iron Mountain & Southern, and that in the future all employees of the Iron Mountain will receive their pay through special pay agents.

The steamer "Empress of China," which reached Victoria, B. C., February 3, broke the record held by the "Empress of Japan," making the fastest trip between Yokohama and Victoria, 10 days, 3 hours, 30 minutes.

The Bureau of Corporations has submitted a series of questions to navigation companies engaged in coastwise, lake and river transportation, to ascertain their relations with the railroads and their traffic arrangements.

The Missouri House passed a bill, February 4, making 2 cents the maximum rate that may be charged for carrying passengers on any railroad in the State, except branch lines less than 40 miles long and under independent ownership. These short lines are allowed to charge 3 cents a mile.

It is reported from St. Paul that the temperature has been below zero almost continuously for three weeks. McHenry, N. Dak., the terminus of a Northern Pacific branch, reported 48 degrees below, February 5, and said that there had been no freight trains there since December 18, and that all fuel, including gasolene, was gone.

The Minneapolis, St. Paul & Sault Ste. Marie is said to be facing the worst snow blockade in its history. It is said that over a stretch of 300 miles, from Kenmare to the international boundary line, not a car has been moved since the day after Christmas, and should the present conditions continue, officials fear business will be hampered until spring.

Senator Heyburn presented a resolution in the Senate February 5 providing for a special committee of five Senators to "investigate the reorganization of the Northern Pacific property, to ascertain what title and estates are owned by the corporation, which was created by act of Congress of July 2, 1864, and if said Federal corporation has no title or estates in any property, then what reason there is why said charter act should not be fully repealed by Congress."

At a hearing in the Harriman merger case, at San Francisco, January 30, before Interstate Commerce Commissioner Lane, W. A. Bissell, assistant traffic manager of the Santa Fe system and director in the Western Pacific Railroad, testified that the Santa Fe and the Southern Pacific managements are observing an unwritten agreement, whereby they share about equally the citrus fruit traffic of southern California, each scrupulously avoiding any intrusion into the other's territory after the fruit has been packed.

Immigration officials at Winnipeg announce that 59,000 laborers will be required this season for work on new railroads in the Canadian Northwest. This estimate is based on returns from the leading contractors as to their requirements for the large undertakings now in hand, including the Grand Trunk Pacific and extensions of the Canadian Pacific and Canadian Northern. Contractors are depending on new immigrants to a larger extent than in any previous season, and some anxiety is felt for fear a shortage in the volume of immigration may cause delays in railroad construction.

A bill has been introduced in the lower house of the North Carolina General Assembly to prohibit railroads or other public service corporations from paying stockholders more than 6 per cent. on actual value of the corporation's property and requiring the company to retain in its treasury an amount equal to 10 per cent. on the property value. At the end of the year all net earnings over the 6 per cent. dividend and the 10 per cent. reserve is required to be paid into the state treasury. The bill also gives the corporation commission power to fix salaries of officers and investigate and regulate in detail the management of the public service corporations.

Under the adjustment reached February 5, all conductors, trainmen and yardmen of the Southern Railway are to receive an increase in wages, the total amount involved being between $350,000 and $400,000 a year. No flat percentage of increase in wages is given to any class of employees, the increase in every case being dependent on conditions. The increase amounts, however, from 6 per cent. as the minimum to 25 per cent. as the maximum. Through freight conductors are to be paid on a basis of $3.18 a hundred miles; local freight conductors, $3.80 a hundred miles; local freight brakemen, $2.15 a hundred miles, and through freight brakemen, $1.75 a hundred miles.

Employers' Liability Law Before the Supreme Court.

In the United States Supreme Court, on application of Attorney General Bonaparte, the case of Damselle Howard, Administratrix, Plaintiff in Error v. The Illinois Central Railroad Company *et al.* has been set down for argument April 8. This case is most important, as it involves the constitutionality of the national "Employers' Liability Act."

Damselle Howard brought suit against the Illinois Central in the United States Circuit Court for the Western District of Tennessee to recover damages for the death of Will Howard, her son, a locomotive fireman, due to the negligence of the railroad company, basing her claim for damages upon the Act of Congress approved June 11, 1906, commonly known as the "Employers' Liability Act." Judge McCall, following a similar decision by Judge Evans of the Western District of Kentucky, held the Act invalid because unconstitutional. This decision was made January 1, 1907. Attorney General Bonaparte, deeming the Act of Congress thus held invalid by the court to be of great public importance, resolved to attempt to have the decision reversed. Only once before has similar action been taken by the Department of Justice. In the case of Johnson v. Southern Pacific Company the decision of the lower court nullified the application of the Federal Safety Appliance Act. Intervention was asked by the Attorney General and granted by the Supreme Court. The decision by Chief Justice Fuller in that case reversed the action of the court below and sustained the validity of the statute in all important parts. The plaintiff in this case is a poor colored woman. All the resources of the Department of Justice will be used to sustain the constitutionality of this Act of Congress.

Theodore P. Shonts.

A typical business man of the West, outspoken and hearty of manner, powerful of build; an indefatigable worker, a fighter, and a "good fellow" whenever good fellowship does not interfere with business—that is the sort of traction chief New York is to have. As President of the Interborough-Metropolitan Company, he is commissioned to transform into a harmonious system the now unbalanced network of urban railroads intersecting the city's most densely peopled districts overhead, underground and on the surface. For this work he has had no special preparation. His assets are general fitness, proved ability as an organizer, and experience as a builder and officer of steam railroads.

In 1882, when he was 26, Mr. Shonts became a railroad contractor. After building two lines in Iowa he helped to build the Indiana, Illinois & Iowa, of which he was General Superintendent from 1882 to 1886, General Manager until 1902, and President from 1898 to 1902. It was in 1898 that Mr. Shonts and Paul Morton got control of the road's stock, and they kept it until the Vanderbilts bought them out, giving each a profit of nearly $1,000,000. The two partners then became interested in the Toledo, St. Louis & Western, of which Mr. Shonts was elected President in January, 1904.

President Roosevelt first heard of Mr. Shonts through Paul Morton, then Secretary of the Navy. He listened to Morton's praise and invited the westerner to visit him at the White House. From the

first he liked Shonts. Especially did he like the visitor's demand: "I'll not touch the job, Mr. President, unless I can have absolute authority."

Of his own accomplishments on the Isthmus, Mr. Shonts has spoken as follows: "If we have not, as our critics complain, made the 'dirt fly,' we have made the filth fly, and we have made yellow fever, that supreme terror of the tropics, fly so far from the Isthmus that it will never, let us hope, find its way back again."

Among the things Mr. Shonts did as chairman were these: He launched the building of complete water and sewage systems, the paving of Panama and Colon, and the cleansing of both cities, and the organization of a sanitary force now entirely equipped for maintaining the healthful conditions of the country. He caused the building of quarters for the army of workers, opened the commissary stores, and arranged for transporting food supplies to the Isthmus with regularity and celerity, though the base of supplies was 2,000 miles away.—*New York Evening Post.*

M. M. and M. C. B. 1907 Conventions.

A circular is being distributed by J. W. Taylor, 390 Old Colony Building, Chicago, Secretary of the American Railway Master Mechanics' Association, and the Master Car Builders' Association. The 1907 conventions will be held at Atlantic City, N. J.; the M. M. convention on June 12, 13 and 14, and the M. C. B. convention on June 17, 18 and 19. Meetings will be held in the sun parlor on the steel pier, and the headquarters of both conventions will be at the Marlborough-Blenheim hotel. The circular gives the rates agreed on by the various hotels.

Panama Construction Company Incorporated.

The certificate of incorporation of the Panama Construction Company was filed at Albany, N. Y., Feb. 4. The company plans to build the Panama Canal if the government awards the contract to W. J. Oliver and associates. The officers are as follows: President, John B. McDonald; First Vice-President and General Manager, W. J. Oliver; Chairman of the Board, R. A. C. Smith; Secretary and Assistant Treasurer, D. V. Reynolds; Treasurer, R. A. Chester. Executive Commitee: John B. McDonald, W. J. Oliver, John Peirce, R. A. C. Smith, R. A. Chester. Board of Directors: John B. McDonald, John Peirce, Charles H. Ackert, Robert A. C. Smith, Robert A. Chester, George Peirce, Patrick T. Walsh, William H. Sayre, Patrick J. Brennan, George F. Harriman, Robert Russell. Mr. McDonald will have his offices in New York and Mr. Oliver will spend his time at Panama. A syndicate of surety companies will furnish the $2,000,000 bond required by the government. The authorized capital of the company is $5,000,000, and the sum of $1,500,000 is announced as paid up. The principal offices will be in New York city.

Western Pacific Terminals at Oakland, California.

The United States Circuit Court of Appeals has reversed the decision of the Circuit Court which was in favor of the Southern Pacific in its claim to title of the filled-in land north of the retaining wall at the mouth of the estuary at Oakland, Cal. The latest decision is that the grant of land by the town of Oakland to parties who afterward sold it to the Southern Pacific only applied and gave title to land extending to the low tide line of 1852, and that therefore the Southern Pacific now has no claim to the long strip of filled-in land extending out into the harbor. It is on this land that the Western Pacific plans to build its terminal. A year ago it laid tracks there and held possession by force until an injunction was granted restraining it from further building. The above decision holds that the made land is the property of the state.

Car Loading and Detention.

The following figures were prepared by E. D. Sewall, assistant to the President of the Chicago, Milwaukee & St. Paul: St. Paul's average freight equipment last year was 42,658 cars, of which about 3 per cent. always were on repair tracks. Average daily loading was 10.4 per cent. of cars in service. Daily loading varied 1,634 cars. This variation represents 13,572 cars, or an investment of $10,800,000, based on average value of all the equipment in freight service. In other words, there is idle during the dull season 30 per cent. of the entire equipment, even in an active year.

During the rush seasons the road is often 20 per cent. behind its orders for equipment, on which basis it would require 8,532 cars additional, at a cost, including the motive power, of $8,300,000. Interest on this additional capital at 5 per cent. plus maintenance would be $1,395,000. Detention of cars exceeds the time in transit.

Baldwin Locomotive Works Fire.

On Tuesday night, January 29, fire destroyed one of the Baldwin Locomotive Works buildings, which included the erecting shop, paint shop and drawing room for electric locomotives. The building burned was four stories, fronting 230 ft. on Spring Garden street, and 208 ft. on Fifteenth street. The loss is estimated to be within $500,000; insured for $309,000. But, as Mr. A. B. Johnson says: "The principal loss, and one which it will be exceedingly difficult to replace, is that of all our drawings for electric locomotives and trucks, which were destroyed."

The situation was met by a fine example of picturesque energy. The fire started at 5.40 in the evening, while Mr. S. M. Vauclain, the General Superintendent, was on the steamer from Cape Charles, arriving at Fortress Monroe at 6.40. The news reached him by telephone; he caught the return boat at 7.10, and at 5 o'clock next morning he was in the burned shop and had matured plans of procedure when the workmen came at 7 o'clock. The upper floors were burned, but by 1 o'clock the two lower floors were cleared and in working order, with new belting, line shafts, repaired machinery, etc. Working full force through the day and all night, by 7 o'clock Thursday morning the debris was cleared and the damaged walls were taken down. The builders soon began replacing as much of the structure as will be used for the former purposes. Part of the space, 120 ft. x 50 ft., will be occupied by an extension of the present office building. During the fire week the firm shipped 54 locomotives.

Pass Contract Not Affected by Rate Law.

Judge Walter Evans, in the Federal Court at Louisville, Ky., Feb. 2, overruled the demurrer of the Louisville & Nashville to the equity petition filed by Erasmus L. and Annie M. Motley, in which the latter sought to enforce a contract by which the railroad company agreed to issue annual passes to each of the plaintiffs during their lifetime. The court says that the act of June 29, 1906, known as the Railroad Rate bill, under which the railroad company declined to issue the passes as agreed in January, 1907, should be construed precisely as if, in its general language, there was an express exception excluding from its operation the complainants' contract. In no other way can the vested contract rights of the complainants be preserved. The court says further that the passes issued to the Motleys, while called "free passes," were not so any more than a ticket bought and paid for.

Mail Payments.

The House Committee on Post Offices and Post Roads reached an agreement, Jan. 31, on the matter of compensation of railroads for carrying the mails.

The committee as first agreed to recommend a reduction of 5 per cent. in the price paid for carrying 48,000 lbs. or less per day and 10 per cent. reduction from the present price for carrying 48,000 to 80,000 lbs. per day, with a flat rate on all over this amount of $18 per ton per mile per annum, a reduction from $21.37½ per ton. The roads at first agreed to accept the 5 and 10 per cent. reductions if the flat tonnage rate were fixed at $20 per ton.

The committee refused to accede to this and an agreement was finally reached that the price should be $19 per ton per mile per annum.

The committee also voted to reduce the rent of postal cars about $1,000,000 annually and also to deduct from the tonnage the weight of the mail bags. The department was unable to estimate what amount would be saved by the elimination of the bags.

Delayed Grain Movement in the Northwest.

Fifty million dollars is a low estimate of the amount of money tied up by the action of the railroads in not handling the grain crop early. Circumstances occurred later—like the great snow storms—which tied up the roads and made it impossible to take care of the traffic, and the railroads also have lost heavily. The policy of holding back shipments so that earnings may be equalized the year round, month by month, has been an expensive one, and it is likely to produce a revolution in railroading. The roads must be prepared to take care of the traffic quickly and clean it up. The effect will be to do away with agreements to hold back until lake navigation is over, that the roads may enjoy a longer haul of freight, and this lesson will teach the farmer the value of having storage facilities for his grain independent of the railroads, and then if he is forced to pay a high rate of freight during the winter months he can wait till summer and ship via the lake route. At the same time he will be able to raise money on his stored grain in case of necessity. In fine, the situation this winter has taught the railroads, the grain grower, and the fuel dealer a lesson that they should never forget.—*New York Evening Post.*

Iowa Demurrage Bill.

A reciprocal demurrage bill was introduced in the Iowa General Assembly, Feb. 1, providing that it shall be the duty of every railroad company upon the verbal or written application of any shipper to its agent for a car or cars to be loaded with other than perishable matter to state the character of the freight and its destination, to furnish said cars within three days from 7 o'clock a. m. of the day following the application, unless prevented by some unavoidable cause. For failure to comply with this request it is provided the company must pay $2 a day a car, together with all damages the applicant may sustain.

After delivery of cars is made the applicant under the measure is allowed 48 hours to load. After they are loaded it is provided the

company must carry them forward at a rate of not less than 80 miles a day for 24 hours, and in failure of this provision makes the company liable to the shipper $2 a car a day. It is further provided the railroad company shall give notice to the consignee of arrival of cars 24 hours after their arrival. In failure of this provision makes them liable of $2 a car a day.

On the other hand, shippers are to have 48 hours for loading cars of a capacity of less than 80,000 lbs., computing from 7 o'clock a. m of the day after such car is placed, and the shipper must pay to the company $2 a day a car for every day's delay, unless such is unavoidable. It is further provided that the railroad company shall not be compelled to deliver cars for shipments to persons in default of payment of fine. This provision, it is believed, will give to the railroad companies ample protection against indiscriminate demand for cars and neglect upon the part of shippers to load when such cars are delivered. It is further provided that where goods are shipped in less than carload lots the company may charge for more than 48 hours' storage one cent per 100 lbs. In carload lots not more than 10 cents a ton a day or fraction thereof. Under the provision of this bill it is permissible for two or more shippers to begin joint actions against a company in suits for collection.

Manufacturing and Business.

Charles S. Henry, Manager of the Chicago office of the New York Air-Brake Co., died at his home in Evanston, Ill., on January 27.

John E. Zimmermann, formerly Secretary of the American Pulley Co., Philadelphia, has become a partner in the firm of Dodge & Day, Engineers, Philadelphia.

Robert W. Hunt & Co., Chicago, have been appointed Consulting Engineers to the Receivers of the Union Traction Company, Chicago, and placed in direct charge of the lowering of the car tunnels under the Chicago river.

Dodge & Day, Engineers, Philadelphia, are building the new shops for the Jones & Lamson Machine Co. at Springfield, Vt. The work is being pushed as rapidly as possible and the order for the steel has already been placed.

A fire occurred on the night of January 31st in the machine shop at the works of the Federal Railway Signal Company at Troy, N. Y., which was destroyed. The officers of the company say they have already made arrangements to go on with their production and hope to be in full swing again in 30 to 45 days.

According to press despatches from Sharon, Pa., plans have been completed by the Standard Steel Car Company for an addition to its plant at New Castle. The extension will occupy ten acres of ground, and the main building will be 1,100 ft. long. It will be devoted to building motor trucks and car frames.

Among orders recently received by the Power Specialty Co., 111 Broadway, New York, for Foster superheaters are the following: Northern Colorado Power Co., Denver Gas & Electric Co., Norwich & Westerly Electric Railroad, Haverhill Electric Co., Electric Company of America, Allis-Chalmers Co., Westinghouse, Church, Kerr & Co.; Westinghouse Electric & Mfg. Co., Ingersoll-Rand Co. Each order is for upwards of 5,000 h.p.

The Revolute Machine Company has received an order for two Everett-McAdam blue printing machines for the Baldwin Locomotive Works. This order was given on the morning after the fire in which the blue printing plant of the locomotive works was destroyed. One of the machines had been in the plant for a year, and a second had been ordered. It was requested that the latter be shipped immediately, making in all three new machines.

The General Railway Signal Co. is arranging to change its place of manufacture from Buffalo to Rochester, N. Y. When the company was organized, in 1904, and acquired the property and business of the Taylor Signal Co. and the Pneumatic Signal Co., it owned well-appointed works in Rochester as well as in Buffalo, but all work was concentrated at the Buffalo plant. It is now reported that the Buffalo real estate is to be sold to the Continental Telephone Co.

Henry Clark Sergeant, of the Ingersoll-Sergeant Drill Company, part of the Ingersoll-Rand Company, died at his home in Westfield, N. J., on January 30 at the age of 72. Mr. Sergeant had a notable inventive faculty which early asserted itself. His first United States patent, issued when he was 19, was for a boiler feed. A list of other patents granted to him in his early life suggests the range of his inventive genius. A governor for marine engines to prevent their racing when the wheels were out of water, patented by him in December, 1858, was adopted by the United States government for the navy. Other patents granted to him were for gas regulators, steam pumps, four for steam boilers, five for brick machines, six for water meters and one for a fluting machine. In the early seventies, when Mr. Sergeant was at the head of a machine shop of his own in New York City, he came to know Simon Ingersoll, who was developing the first Ingersoll rock drill, then an untried device. The two men formed the Ingersoll Drill Company. Mr. Sergeant worked particularly on adapting compressed air to the drills for mine and tunnel work. In 1886 he formed the Sergeant Drill Company independently, but two years later again joined Mr. Ingersoll, when the Ingersoll-Sergeant Drill Company was formed with Mr. Sergeant as its first president. As an evidence of his active mind and wide diversity of interests he was in his earlier years a public lecturer and a champion skater; later in life when a director of the Third Avenue Elevated Railroad, he designed the ticket canceling box, now used on the elevated and subway lines of New York City, which so mutilates the ticket as to make it impossible to defraud the company by using it again. He was quick to see the best way to do the thing which came in his way to do.

Iron and Steel.

Recent orders for rails have been only for small lots for electric lines.

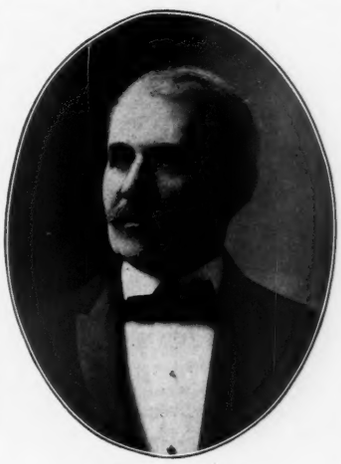
The Council City & Solomon River, which is extending its line in Alaska, is reported to be in the market for 10,000 tons of rails.

The Pennsylvania Company has ordered from the Carnegie Steel Company rails and 4,000 tons of tubular steel for the Pennsylvania Railroad tunnels and terminals at New York.

The Norfolk & Western has ordered 3,000 tons of steel for bridges; the Chicago, Milwaukee & St. Paul 2,860 tons, and the Pennsylvania 1,360 tons. The Delaware & Hudson has given an order for 1,300 tons of steel for bridges to the American Bridge Company. It is reported from Pittsburg that 20,000 tons of steel plates have recently been sold.

OBITUARY NOTICES.

Capt. George J. Grammer, Vice-President in charge of freight traffic of the New York Central Lines, died on February 4 at Chicago after an illness of several weeks. His death was directly due to a relapse following an operation. Capt. Grammer was born in 1845 in Ohio. After several years' experience on western river steamship lines, he began railroad work, in 1881, as General Freight and Passenger Agent of the Evansville & Terre Haute. He was made Traffic Manager of that road and of the Evansville & Indianapolis two years later, and in 1886 was made General Traffic Manager of the two roads. Later his authority was extended over the Peoria, Decatur & Evansville, the Louisville, Evansville & St. Louis, and the Chicago & Eastern Illinois. In 1892 he was elected President of the Evansville & Terre Haute, the Evansville & Indianapolis and the Evansville & Richmond. In 1894 he went to the Chesapeake, Ohio & Southwestern as General Manager, and, a few months later, was made General Freight Agent of the Lake Shore & Michigan Southern. He was appointed General Traffic Manager of the last named road in 1896, and in 1905 was elected Vice-President in charge of the New York Central Lines west of Buffalo. In the latter part of 1906 he was elected Vice-President in charge of freight traffic of all the New York Central Lines.



G. J. Grammer.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

Purdue University.

At a meeting of the Engineering Assembly of Purdue University on January 28, an address was delivered by Harrington Emerson, an expert production engineer, on Railroad Operating Records. An article by Mr. Harrington on Finished Repair Parts for Locomotives was published in the *Railroad Gazette*, Nov. 23, 1906.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Atchison, Topeka & Santa Fe.—See Denver, Enid & Gulf.

Atlanta & West Point.—W. H. Smith, Acting Auditor, has been appointed Auditor.

Chicago, Rock Island & Pacific.—J. H. Mather, claim agent at Des Moines, Iowa, has been appointed General Claim Agent, with office at Chicago, Ill.

Denver, Enid & Gulf.—E. P. Ripley, President of the Atchison, Topeka & Santa Fe, has been elected also President of the Denver, Enid & Gulf.

Detroit & Toledo Shore Line.—G. W. Alexander has been appointed Secretary and Treasurer, with office at Detroit, Mich., succeeding J. H. Muir, deceased.

Detroit, Toledo & Ironton.—W. L. Greenhalgh, Assistant Treasurer, has resigned.

Elmina & Eastern Transportation Company.—W. B. Clint, Vice-President and Auditor, has been appointed General Manager and Auditor, with office at Elmina, Tex. P. M. Shannon succeeds Mr. Clint as Vice-President, with office at Pittsburg, Pa.

Galveston, Beaumont & Northeastern.—The officers of this company are as follows: President, A. W. Miller; Vice-President, C. S. Vidor, both with office at Galveston, Tex.; Auditor, W. H. Brooks; Traffic Manager, E. H. Green, Jr., and General Superintendent, W. E. Halliday, all with office at Beaumont, Tex.

Kalamazoo, Lake Shore & Chicago.—The officers of this company are as follows: President, S. J. Dunkley; Vice-President, G. E. Bardeen; Secretary and General Manager, James Grant; Traffic Manager, H. D. Swayze, and Acting Auditor, A. L. Waldo, all with office at Kalamazoo, Mich.

Licking River.—W. H. Allington, Treasurer, has been elected also President, with office at Salt Lick, Ky., succeeding R. H. Lanyon.

Norfolk & Southern.—E. R. Baird, Jr., has been appointed General Solicitor, with office at Norfolk, Va.

Northwestern Pacific.—The officers of this company, which is a consolidation of Southern Pacific and Santa Fe lines in northern California, are as follows: President, E. E. Calvin, of the Southern Pacific; Vice-President, A. H. Payson, of the Santa Fe; Secretary, J. L. Willcutt, and Treasurer, N. T. Smith, both of the California Northeastern; Comptroller, Thomas Mellersh, of the California North-Western.

Oregon Railroad & Navigation.—See Union Pacific.

Philadelphia, Baltimore & Washington.—James McCrea, President of the Pennsylvania, has been elected also President of the P., B. & W., succeeding A. J. Cassatt, deceased.

Quincy, Omaha & Kansas City.—W. S. Thompson, chief clerk of accounts, has been appointed to the new office of Auditor, with office at Kansas City, Mo.

Savannah & Statesboro.—W. B. Moore has been appointed Auditor, with office at Statesboro, Ga., succeeding D. Van Wagenen, resigned.

South & Western.—The general offices of this company have been removed from Bristol, Va., to Johnson City, Tenn. The office of A. A. Pflegar, Vice-President, has been removed from Christiansburg, Va., to Bristol.

Tacoma Eastern.—Samuel Wilson has been appointed Auditor and General Freight and Passenger Agent, with office at Tacoma, Wash., succeeding J. G. Dickson, resigned.

Tremont & Gulf.—R. H. Jenks, President, has been appointed Secretary and Traffic Manager. W. T. Joyce succeeds Mr. Jenks. L. J. Carpenter has been appointed Treasurer and General Manager.

Union Pacific.—H. J. Stirling, Auditor of the Oregon Railroad & Navigation, has been appointed also to the new office of Auditor of the Union Pacific, with office at Omaha, Neb.

Traffic Officers.

Erie.—E. H. Barto has been reappointed Suburban Passenger Agent, with office at New York.

Seaboard Air Line.—B. M. Waldron has been appointed Freight Claim Agent, with office at Portsmouth, Va., succeeding O. B. Bidwell, Jr., resigned to go to another company.

Trinity & Brazos Valley.—D. C. MacWatters, formerly General Passenger Agent of the Colorado Springs & Cripple Creek District, has been appointed General Passenger Agent of the Trinity & Brazos Valley, with office at Fort Worth, Tex.

Operating Officers.

Alabama Great Southern.—See Cincinnati, New Orleans & Texas Pacific.

Algoma Central & Hudson Bay.—J. S. Wynn, General Auditor, has been appointed Acting Manager, succeeding to the duties of W. N. Sawyer, General Manager, resigned.

Chicago & Alton.—See Chicago, Indiana & Southern.

Chicago Great Western.—Otto Cornelison, Superintendent of the Clarion division, has been appointed Superintendent of Transportation, with office at St. Paul, Minn. L. M. Shipley, Superintendent of Terminals at Oelwein, Iowa, succeeds Mr. Cornelison. Maurice Daily, Master Mechanic of the Des Moines division, succeeds Mr. Shipley.

Chicago, Indiana & Southern.—E. Ryder, Superintendent of the Chicago & Alton at Bloomington, Ill., has been appointed to the new office of General Superintendent of the C., I. & S., with office at Chicago, Ill., effective February 15.

Chicago, Rock Island & Pacific.—John McGie, Master Mechanic at Little Rock, Ark., has been appointed Superintendent of the Panhandle division, with office at Geary, Okla. T. W. Rudd has been appointed Superintendent of the Indian Territory division, with office at Haileyville, Ind. T.

Chicago, St. Paul, Minneapolis & Omaha.—Edward Digle has been appointed Superintendent of Terminals at East St. Paul, Minn., with authority over the St. Paul and Minneapolis yards.

J. R. Welsh has been appointed Assistant Superintendent of the Wisconsin division, with office at Spooner, Wis.

Cincinnati, New Orleans & Texas Pacific.—W. T. Caldwell, Superintendent of Terminals of the Missouri Pacific at Little Rock, Ark., has been appointed to the new office of Inspector of Transportation of the Cincinnati, New Orleans & Texas Pacific and of the Alabama Great Southern.

W. S. Andrews has been appointed to the new office of Assistant to the General Manager, with jurisdiction over the transportation department.

Flint River & Northeastern.—W. A. Olliff has been appointed Superintendent of Transportation and Car Accountant of this road and of the Georgia Northern.

Georgia Northern.—See Flint River & Northeastern.

Grand Trunk.—D. Crombie has been appointed Master of Transportation, with office at London, Ont., succeeding S. Ennes, transferred.

L. H. Nolan has been appointed to the new office of Superintendent of Terminals at Detroit, Mich., with office at Milwaukee Junction, Mich.

Illinois Central.—C. L. Ewing, Superintendent at Carbondale, Ill., has been appointed General Superintendent of Northern and Western lines, succeeding F. B. Harriman, promoted. C. R. Wescott, Trainmaster at East St. Louis, Ill., has been appointed Superintendent of the Springfield division, with office at Clinton, Ill., succeeding Charles Dougherty, resigned to go to the Cincinnati, New Orleans & Texas Pacific.

Licking River.—J. B. Shaw, Trainmaster, has been appointed Superintendent, with office at Yale, Ky.

Loring & Western.—B. M. Musser has been appointed General Superintendent, with office at Loring, La., succeeding J. T. Burlingame, resigned.

Mexican Railway.—H. A. McCulloch, Marine Superintendent, has resigned and the office has been abolished. See Pan-American.

Missouri, Kansas & Texas of Texas.—W. W. Hoffman has been appointed Trainmaster of the Waco, Houston, Austin and San Antonio divisions and the Belton branch, with office at Smithville, Tex., succeeding H. G. Evans, resigned.

Missouri Pacific.—C. H. Bevington has been appointed Superintendent of the Omaha division, with office at Omaha, Neb., succeeding J. Russell, resigned.

See Cincinnati, New Orleans & Texas Pacific.

Oregon Short Line.—See Union Pacific.

Pan-American.—H. A. McCulloch, Marine Superintendent of the Mexican Railway, has been appointed Assistant General Manager of the Pan-American, succeeding C. B. Cox, resigned.

Pittsburg & Lake Erie.—F. S. Weigel, Assistant Trainmaster, has been appointed to the new office of Assistant Superintendent, with office at Pittsburg, Pa.

Rio Grande Junction.—J. Q. Matthews has been appointed Acting Superintendent, with office at Grand Junction, Colo., succeeding W. A. Whitney, Superintendent, promoted.

Southern.—B. G. Fallis, formerly Superintendent of the Missouri Pacific at Chester, Ill., has been appointed Superintendent of the Charlotte division of the Southern, with office at Charlotte, N. C., succeeding P. L. McManus, promoted.

Union Pacific.—E. M. Botsford has been appointed Acting Assistant Superintendent of the Wyoming district of the Union Pacific lines west of Green river, and of the Utah division of the Oregon Short Line, succeeding H. J. Roth, resigned.

Vera Cruz & Pacific.—W. A. Hill has been appointed Superintendent, with office at Tierra Blanca, Mexico.

Wisconsin Central.—See Wisconsin Central under Purchasing Agents.

Engineering and Rolling Stock Officers.

Atchison, Topeka & Santa Fe Coast Lines.—A. B. Todd, Master Mechanic of the Los Angeles division, has been appointed Master Mechanic of the Valley division, with office at Richmond, Cal., succeeding E. H. Harlow, transferred to the First district of the Albuquerque division, with office at Albuquerque, N. Mex. I. C. Hicks, whom Mr. Harlow succeeds, is transferred to the Los Angeles division, with office at San Bernardino, Cal., succeeding Mr. Todd.

Baltimore & Ohio.—J. Kirkpatrick, Master Mechanic at Cumberland, Md., has been appointed Master Mechanic at Newark, Ohio, succeeding G. J. DeVilbiss, resigned to go to the Hocking Valley. A. H. Hodges, general foreman at Brunswick, Md., succeeds Mr. Kirkpatrick. See Hocking Valley.

Chicago Great Western.—See Chicago Great Western under Operating Officers.

Chicago, Rock Island & Gulf.—C. M. Case has been appointed Chief Engineer, with office at Fort Worth, Tex., succeeding J. S. Peter, resigned.

Chicago, Rock Island & Pacific.—H. M. Stone has been appointed Engineer of the Northern district, with office at Cedar Rapids, Iowa, succeeding Garrett Davis, transferred. J. G. Bloom, Engineer of Maintenance at Topeka, Kan., has been appointed Engineer of the Southwestern district, with office at Topeka. See Chicago, Rock Island & Pacific under Operating Officers.

Cincinnati & Muskingum Valley.—R. R. Metheany, Jr., Assistant Engineer of the Southwest System of the Pennsylvania Lines West at Louisville, Ky., has been appointed Assistant Engineer of the Cincinnati & Muskingum Valley, with office at Zanesville, Ohio, succeeding H. W. Brown, transferred.

Erie.—T. Rumney, Assistant Mechanical Superintendent, has been appointed Mechanical Superintendent, succeeding George W. Wildin, resigned to go to the Lehigh Valley. E. A. Wescott, general foreman of car repairs at Kent, Ohio, succeeds Mr. Rumney. William Schlafge, Master Car Builder, has been appointed to the new position of General Master Mechanic. The offices of all are at Meadville, Pa.

Fort Worth & Denver City.—A. M. Mullinix has been appointed Superintendent of Bridges, Buildings and Water Service, with office at Fort Worth, Tex., succeeding O. J. Travis.

Halifax & Southwestern.—L. H. Wheaton, who for the last two years has been Chief Engineer in charge of the construction of this recently completed road, has been appointed Engineer of Maintenance of Way, with office at Bridgewater, N. S.

Hocking Valley.—S. S. Stiffey, Superintendent of Motive Power of this company, of the Toledo & Ohio Central, of the Kanawha & Michigan, and of the Zanesville & Western, has been appointed to the new office of General Superintendent of Motive Power of these companies. G. J. De Vilbiss, Master Mechanic of the Baltimore & Ohio at Newark, Ohio, succeeds Mr. Stiffey, with office at Columbus, Ohio.

Illinois Central.—F. L. Thompson, formerly roadmaster of the Louisville division, has been appointed Assistant Engineer of Bridges, in charge of track elevation.

Kanawha & Michigan.—See Hocking Valley.

Oregon Short Line.—See Union Pacific.

Pennsylvania Lines West.—See Cincinnati & Muskingum Valley.

Portland & Rumford Falls.—A. R. Manderson has been appointed Master Mechanic, with office at Rumford Falls, Me., succeeding M. R. Davis, resigned.

Santa Fe Central.—T. J. Tonge has been appointed Superintendent of Motive Power, Rolling Stock, Bridges, Buildings and Water Service, with office at Estancia, N. Mex.

Southern Pacific.—R. M. Drake, resident engineer of the Western division, has been appointed Engineer of Maintenance of Way of the Northern district, with office at San Francisco, Cal., succeeding W. C. Edes, resigned to go to another company.
See Union Pacific.

Toledo & Ohio Central.—See Hocking Valley.

Tremont & Gulf.—J. H. Scott has been appointed Superintendent and Chief Engineer. N. Greener, Master Mechanic, has been appointed Superintendent of Motive Power.

Union Pacific.—F. W. Newcombe has been appointed Signal Engineer of this company's lines east of Green river, of the Oregon Short Line, and of the Southern Pacific lines east of Sparks, with office at Ogden, Utah.

Vera Cruz & Pacific.—P. C. Morales has been appointed Acting Master Mechanic, with office at Tierra Blanca, Mex.

Zanesville & Western.—See Hocking Valley.

Purchasing Agents.

Norfolk & Southern.—H. W. Davies has been appointed Purchasing Agent, succeeding W. R. Burrows, resigned. Mr. Davies is 36 years old, and has been in the accounting department of the Southern for the last four years. During the 12 years previous he was in the local freight department of the same road.

Wisconsin Central.—C. W. Booth, Assistant General Superintendent, has been appointed Purchasing Agent, with office at Milwaukee, Wis., succeeding J. A. Whaling, and the office of Assistant General Superintendent has been abolished.

LOCOMOTIVE BUILDING.

The Northern Pacific has ordered 25 switching locomotives from the American Locomotive Co.

The St. Louis & San Francisco has ordered 45 locomotives from the Baldwin Locomotive Works.

Fox Brothers & Co. are about to place a contract for locomotives for a Porto Rico plantation railroad.

The Brinson Railway has ordered some locomotives from the Baldwin Locomotive Works. G. M. Brinson, Savannah, Ga., is President.

The Middletown & Cecilton, now under construction, will soon ask bids on locomotives. W. R. Polk, Middletown, Del., is General Manager.

The Williamsville, Greenville & St. Louis has ordered one ten-wheel 54-ton locomotive from the East St. Louis Locomotive & Machine Shop Co. for February delivery.

The Great Northern has ordered 10 switch engines from the Baldwin Locomotive Works instead of 15, as reported in our issue of January 25. This, together with the 100 Prairie, 25 Mallet and 15 Pacific type already ordered, makes a total of 150 locomotives for 1907 delivery. The switch engines will be six wheel and the general dimensions follow:

Type of locomotive	Switching
Total weight, engine and tender	215,000 lbs.
Weight on drivers	135,000 "
Diameter of drivers	49 in.
Cylinders	19 in. x 26 in.
Boiler, type	Belpaire
" working steam pressure	200 lbs.
" diameter	66 in.
" number of tubes	291
" diameter of tubes	2 in.
" length of tubes	11 ft. 3 "
Total heating surface	1,873.50 sq. ft.
Grate area	27.22 "
Tank capacity	8,000 gals.

The Atlantic Coast Line, as reported in our issue of January 18, has ordered from the Baldwin Locomotive Works 20 simple six-wheel switch engines, 68 ten-wheel freight locomotives and 12 ten-wheel passenger locomotives. The specifications are as follows:

General Dimensions.

Type of locomotive	Switching.	Ten-wheel.
Weight on drivers	110,000 lbs.	115,000 lbs.
Weight, total	110,000 lbs.	155,000 lbs.
Diameter of cylinders	19 in.	20 in.
Stroke of pistons	24 "	26 "
Diameter of drivers	50 "	68 in. passenger; 63 in. freight.
Type of boiler	Straight top, narrow firebox.	Straight top, wide firebox.
Working steam pressure	180 lbs.	185 lbs.
Heating surface, total	1,669 sq. ft.	2,660 sq. ft.
Tubes, number	213	334
" material	Knobbled charcoal iron.	
" outside diameter	2 in.	2 in.
" length	14 ft.	14 ft. 5 in.
Firebox, length	71⅝ in.	96¼ in.
" width	34¼ in.	66 in.
" material	Steel according to Baldwin Loco. Works specifications.	
Grate area	17.03 sq. ft.	44.1 sq. ft.
Tank capacity	2,500 gals.	6,000 gals.
Coal capacity	8 tons.	10 tons.

Special Equipment.

Air-brakes	Westinghouse
Boiler lagging	Johns-Manville
Brake-beams	Diamond special
Brake-shoes	Perfecto
Couplers	Tower
Headlights	Dressel
Injector	Monitor, for Switching
Injector	Hancock for Ten-wheel
Journal bearing	Damascus bronze
Piston rod packing	U. S. Metallic
Valve rod packing	U. S. Metallic
Safety valve	Star
Sanding devices	Watters
Sight-feed lubricators	Nathan Bull's-eye
Springs	A. C. L. standard
Steam gages	Star brass
Other specialties	Elvin grease lubrication on driving wheels and engine truck journal boxes

The Colorado, Texas & Mexico, now under construction, will ask

bids on locomotives about May 1. George D. Locke, Missouri Trust Building, St. Louis, Mo., is Purchasing Agent.

CAR BUILDING.

The South & Western will shortly be in the market for 2,000 freight cars.

The Missouri Pacific is asking bids on 750 wooden stock cars of 60,000 lbs. capacity.

The Wabash has ordered 1,000 box cars from the American Car & Foundry Company.

The Cleveland, Cincinnati, Chicago & St. Louis is reported in the market for express cars.

The Detroit United has ordered 50 city and 10 interurban cars from the Cincinnati Car Co.

The Boston & Maine is reported to have ordered 1,000 box cars from the Western Steel Car Co.

The Peoria Railway has ordered 15 double truck city cars from the American Car & Foundry Co.

The Missouri & North Arkansas has ordered 100 box cars from the American Car & Foundry Company.

Fox Brothers & Co. are about to place a contract for several cars for a Porto Rico plantation railroad.

The Chicago & Illinois Western is in the market for 300 gondola cars of from 80,000 to 100,000 lbs. capacity.

The Hudson Companies, it is reported, have ordered 250 all-steel passenger cars from the Pressed Steel Car Co.

The Delaware, Lackawanna & Western has ordered a Ganz motor inspection car from the Railway Auto Car Co.

The Guerrero (Mexico) Lumber Milling & Manufacturing Co. will shortly be in the market for logging cars.

The Chicago, Lake Shore & South Bend, now under construction, will order electric cars within a few days.

The Great Northern, as reported in our issue of January 18, has ordered 114 passenger cars from Barney & Smith.

The Brinson Railway has ordered some cars from the Waycross Car Works. G. M. Brinson, Savannah, Ga., is President.

The Great Western Oil Refining & Pipe Line Company, Chicago, is asking bids on 25 tank cars of 8,000 gallons capacity.

The Colorado & Southern, as reported in our issue of January 25, has ordered 33 passenger cars from the Pullman Co.

The Milwaukee Refrigerator Transit Company, Milwaukee, is in the market for 136-ft. refrigerator cars of 60,000 lbs. capacity.

The Middletown & Cecilton, now under construction, will soon ask bids on cars. W. R. Polk, Middletown, Del., is General Manager.

Dolese & Shepard, Chicago, are asking prices on 50 gondolas of 60,000 lbs. capacity, 50 gondolas of 80,000 lbs. capacity, and 50 gondolas of 100,000 lbs. capacity.

The Colorado, Texas & Mexico, now under construction, will ask bids on cars about May 1. George D. Locke, Missouri Trust Building, St. Louis, Mo., is Purchasing Agent.

The Mobile & Ohio is in the market for 1,000 box cars of 60,000 lbs. capacity, 500 steel underframe drop bottom gondola cars of 100,000 lbs. capacity, and 500 drop end gondola cars.

The Colorado & Southern, as reported in our issue of January 4, has ordered 350 stock cars, 350 ore cars instead of 600 ore cars, as reported in our issue of January 30; 175 flat cars, 50 gondola cars and 14 cabooses from the American Car & Foundry Co.

The St. Louis & San Francisco, as reported in our issue of January 25, has ordered 3,000 steel underframe box cars of 80,000 lbs. capacity, 1,000 steel underframe gondolas of 100,000 lbs. capacity, and 500 stock cars of 80,000 lbs. capacity from the American Car & Foundry Co., and 88 passenger coaches from the Pullman Co.

The Mineral Range has ordered 50 hopper bottom rock or coal cars of 80,000 lbs. capacity from the American Car & Foundry Co., for June delivery. These cars will weigh 32,000 lbs., and will measure 30 ft. long, 9 ft. 8 in. wide and 8 ft. 6 in. high, over all. The special equipment is as follows:

Brakes	Westinghouse
Brasses	Camel
Couplers	R. E. Janney
Draft rigging	Gould
Dust guards	Harrison
Journal boxes	Symington
Springs	Railway Steel-Spring Co.
Trucks	Diamond arch-bar
Wheels	American Car & Foundry Co.

The Norfolk & Western, as reported in our issue of February 1, is building at its Roanoke shops 1,000 drop bottom gondola cars of 100,000 lbs. capacity for May to December delivery. These cars will weigh 38,100 lbs. and will measure 38 ft. 2½ in. long, 8 ft. 11½ in. wide and 4 ft. high, inside measurements, and 40 ft. long, 9 ft. 11 in. wide and 7 ft. 11½ in. high, over all. Bodies will be of wood and underframes of metal. The special equipment includes:

Bolsters	Sectional, of plates and angles
Brake-beams	N. & W. standard deck beams
Brakes	Westinghouse
Brasses	Ajax Plastic Bronze
Draft rigging	Butler
Dust guards	Wooden
Springs	Union Spring & Mfg. Co., and Pittsburg Steel & Spring Company.

The Seaboard Air Line, as reported in our issue of February 1, has ordered 1,500 ventilated box cars of 60,000 lbs. capacity, and 1,000 gondola cars of 80,000 lbs. capacity. The box cars will weigh 38,000 lbs., and will measure 36 ft. long, 8 ft. 6 in. wide and 7 ft. 6 in. high, inside measurements, and 37 ft. 9¾ in. long, 9 ft. 6¾ in wide and 13 ft. 5⅝ in. high, over all. The gondola cars will weigh 37,400 lbs., and will measure 40 ft. 6 in. long, 8 ft. 7 in. wide and 3 ft. 3⅛ in. high, inside measurements, and 42 ft. 3½ in. long, 9 ft. 9¾ in. wide and 7 ft. 3⅛ in. high, over all. The bodies of all cars will be of wood, and the underframes of metal. The special equipment for all cars is as follows:

Bolsters, body	Structural or pressed steel
Bolsters, truck	I-beam
Brake-beams	S. A. L. standard
Brakes	Westinghouse
Brasses	S. A. L. standard
Couplers	Tower
Door fastenings	Dayton
Draft rigging	S. A. L. standard
Dust guards	Wooden
Journal boxes	Symington
Paint	S. A. L. standard
Roofs	Chicago or Murphy
Springs	S. A. L. standard
Trucks	S. A. L. standard

RAILROAD STRUCTURES.

AUSTIN, TEX.—The State Railroad Commission has issued an order requiring the Santa Fe, the Southern Pacific, the Galveston, Houston & Henderson and the Missouri, Kansas & Texas to jointly build a concrete causeway 140 ft. wide and two miles long over Galveston bay at a cost of about $4,000,000.

CHICAGO, ILL.—The car barns of the Union Traction Company were recently damaged by fire; loss about $200,000.

KANSAS CITY, MO.—The new viaduct between Kansas City, Mo., and Kansas City, Kan., was formally opened November 29. It is 1.6 miles long, has a level roadway from 40 to 60 ft. wide, and is connected with inclines and elevators for vehicles. The superstructure is of heavy steel on concrete pedestals laid on creosoted and concrete piles. The Kaw river is spanned by a bridge with two sections weighing 1,800 tons, supported by three piers containing 6,415 cu. yds. of concrete.

Bids are wanted February 25, by the Board of Park Commissioners, Kansas City, Mo., for building a reinforced concrete bridge 68 ft. wide and 75 ft. long over Brush Creek at Forty-seventh street and Lydia avenue, to cost about $12,000. Frank P. Gossadd is Chairman of the Board.

The United States Senate has passed a bill authorizing the Interstate Bridge & Terminal Company to build a bridge over the Missouri river at Kansas City.

LAWRENCE JUNCTION, PA.—It is reported that the Pennsylvania will spend $175,000 for new shops and make other improvements during the coming spring.

MINNEAPOLIS, MINN.—About 160 acres of land have recently been bought in St. Anthony Park, a suburb, it is said as a site for freight transfer yards of the Great Northern and Northern Pacific.

PORT ARTHUR, ONT.—The Grand Trunk Pacific has let contracts to Barnett & McQueen for building a large grain elevator to have a capacity of 10,000,000 bushels at the mouth of the Mission river. Four trains will be able to discharge grain into it simultaneously. It is to be built of concrete, steel and tile. Work will be begun early this spring.

ST. LOUIS, MO.—A bill has been introduced in both houses of Congress to authorize the St. Louis Electric Bridge Company, which is a representative of the Illinois Traction Company, otherwise known as the McKinley syndicate, to build a combined highway and railroad bridge over the Mississippi river at St. Louis.

TALLADEGA, ALA.—A bill has been passed by the United States Senate authorizing the Atlanta, Birmingham & Atlantic to build a bridge over the Coosa river.

TORONTO, ONT.—The Canadian Northern has bought 110 acres

of land on the Don Flats as a site on which to build roundhouses, car shops, repair sheds, cold storage plants, etc.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ALABAMA WESTERN.—See Illinois Central.

ALTOONA & LOGAN VALLEY (ELECTRIC).—A certificate has been filed by this company at Altoona, Pa., to build an electric line from Hollidaysburg, Pa., to Frankstown. The company also plans to build a number of extensions in Altoona.

ATCHISON, TOPEKA & SANTA FE.—See Southern Pacific.

ATHABASCA RAILROAD.—This company, which has a charter for a line from Edmonton, Alb., to Fort McMurray, is applying to the Dominion Parliament for permission to also build a line from Fort McMurray to Fort Smith, a total of 490 miles.

ATLANTA & ST. ANDREW'S BAY.—This company has extended its road from Cottondale, Fla., to Domer, five miles.

ATLANTIC & NORTH CAROLINA.—See Norfolk & Southern.

BOSTON & MAINE.—The directors of the Fitchburg have voted to issue $800,000 of bonds to pay for double-tracking the road from Troy, N. Y., northeast to Johnsonville, 16 miles, and eliminating grade crossings.

CANADIAN NORTHERN.—The Oakland, Man., extension is to be built north between the present main line and Lake Manitoba, work to be begun early this spring.

CANADIAN PACIFIC.—It is reported that this company will begin work on a line between Prince Albert and Regina, Sask., 260 miles, early this spring.

CENTRAL & SOUTHEASTERN.—This company, which has projected a line from Chanute, Kan., to Memphis, Tenn., 425 miles, and from the smelters at Chanute to zinc mines in southwest Missouri, has surveys made from Chanute to the Missouri-Arkansas state line. Rights of way have also been secured in Kansas. Ten miles of grading has been done, and a number of bridges put up. A. N. Hoxie, President, Joplin, Mo.; F. S. Hoxie, Secretary, 273 Fifth avenue, New York.

CHESTER, PERRYVILLE & STE. GENEVIEVE.—The Saline Valley has been opened for business from West Chester, Mo., southwest to Minith, 23 miles.

DULUTH, RAINY LAKE & WINNIPEG.—Financial arrangements have been made for building from the southern terminus at Virginia, Minn., on the Mesaba range, to Duluth, 70 miles.

This company has extended its road from Gheen, Minn., to Pelican, seven miles.

HALIFAX & SOUTHWESTERN.—The Barrington section of this road has been opened for business from Barrington Passage, N. S., east to Liverpool, 86 miles.

ILLINOIS CENTRAL.—This company, which is building from Corinth, Miss., southeast to Haleyville, Ala., 80 miles, as part of its Birmingham extension, is building the part of the line in Mississippi under the name of the Mississippi & Alabama, 42 miles, and the remainder in Alabama under the name of the Alabama Western, 38 miles. Contracts for grading, track laying and masonry on the Mississippi & Alabama have been let to Smith & Scott, of Corinth. About 85 per cent. of the grading is completed and track laid for a little over three miles. On the Alabama Western, contracts have been let to the Tallay-Bates Construction Company, Memphis, Tenn.; L. E. Myers Company, Chicago, Ill., and to Smith & Scott, of Corinth, Miss.; also to the Strobel Steel Construction Company, of Chicago, Ill., for the Brush Creek viaduct. Grading is 44 per cent. completed, and track laid for almost two miles.

INTERCOLONIAL.—Contracts have been given to Willard Kitchen, of Fredericton, N. B., for building the Colton Factory Branch from Richmond, N. S., to Kempt Road, Halifax, a little over two miles. Grading is to be started during April.

The company proposes to double track its road between St. John and Hampton, 22 miles, and between Moncton and Painsee Junction, seven miles.

MISSISSIPPI & ALABAMA.—See Illinois Central.

MONCTON, N. B.—The Intercolonial will rebuild six bridges and replace a number of short spans along the line of its road during the present year. A new passenger station is to be built at Amherst, N. S., new machine shops at Riviere du Loup, and a number of other buildings put up.

NORFOLK & SOUTHERN.—Contracts let to H. H. George, Richmond, Va., for building from Raleigh to Zebulon, 25 miles, and to J. G. White & Co., of Wilson, N. C., and New York, from Zebulon to New Bern, 105 miles; other construction includes branch from Farmville on this line south to Snow Hill, 10 miles, an extension from Bayboro south to Oriental, 10 miles, and from Chocowinity to Neuse Junction (near New Bern), 30 miles. The Virginia & Carolina Coast is building from Mackay's Ferry to Columbia, 22 miles, and from Bayboro to Oriental, 10 miles, and the Atlantic & North Carolina, from Morehead City to Beaufort. In addition the Norfolk & Southern is building a cut-off from Bishop Cross west to Pinetown, 10 miles, for which contract has been let to J. L. Wilkinson. Grading completed from Chocowinity to Neuse Junction, 30 miles, and track laid from Pamlico Junction to Zebulon, 23 miles; Bragaw to Neuse Junction, 22 miles; Mackay's Ferry to Cresswell, 13½ miles, and Morehead City to Beaufort about three miles, all the completed work was done last year except 13 miles east of Pamlico Sound, which was built this year. A bridge over the Pamlico River at Washington is now nearing completion. Additional contracts for work from Mackay's Ferry to Edenton, 10 miles, are to be let this spring. It is expected that all these lines will be built during the first half of this year. Charles O. Haines, Raleigh, N. C., Vice-President.

NORTHWESTERN PACIFIC.—See Southern Pacific.

ORFORD MOUNTAIN.—This company is planning to build an extension from Mansonville, Que., to North Troy, Vt., four miles, and from Windsor Mills, Que., to Bromptonville, eight miles.

PENNSYLVANIA.—Considerable heavy construction work is under way on the Pittsburg division, most of which is between Beatty and Southwest Junction, and calls for the excavation of 640,000 yds. and the placing of 18,500 yds. of masonry, which has just been finished. Near Donohue about five miles the work involves 1,600,000 yds. of excavation, of which 861,000 yds. are in one cut at Donohue Summit. The cut is 3,000 ft. long and 100 ft. deep. About 200,000 yds. at Donohue Summit must be cut through solid rock. It is expected that the entire excavation will be completed this spring. All the masonry for this section has been completed, except the bridge over the Alexandria branch. This new section of line shortens the present distance by about 1,000 ft. and eliminates 210 degrees of curvature besides very bad features in the present construction between Donohue and Beatty. The old line went through a tunnel.

RALEIGH & PAMLICO SOUND.—See Norfolk & Southern.

RIO GRANDE, SIERRA MADRE & PACIFIC.—Col. C. W. Greene and associates, who have been granted a concession by the Federal Government to build a line from Nueva Casas Grandes, state of Chihuahua, Mexico, to La Dura, in the state of Sonora, about 400 miles, have organized the Sierra Madre & Pacific to carry out this work. The line is to be built as an extension of the Rio Grande, Sierra Madre & Pacific owned by the same interests. The new line will connect with the Cananea, Yaqui River & Pacific at La Dura. Surveys made and contracts for the work will soon be let.

ST. LOUIS, ROCKY MOUNTAIN & PACIFIC.—Regular train service nas been begun on 41 miles of the main line between Clifton House, N. Mex., and Cimarron, and on 11 miles of branches to Koehler and to Raton. Grading has been completed for 96 miles from Des Moines west towards Ute Park, and track laid for 82 miles on the main line, leaving 24 of the 106 miles on the contract. The whole road is to be ready for operation by April 1. Eighty-lb. rails have been laid on the main line and 70-lb. rails on the branches. A large yard is being built near Koehler Junction.

SASKATCHEWAN VALLEY & HUDSON'S BAY.—This company is applying for incorporation to build a line from Edmonton, Alb., to Fort Churchill, on Hudson's Bay, via Prince Albert, approximately 1,500 miles. G. E. McCraney, Ottawa, is interested.

SEABOARD AIR LINE.—A 20-mile extension has been authorized from Jacksonville Ala., to Anniston, Ala., where the Woodstock furnaces, pipe works, etc., are located, as well as several short lines to mines in Calhoun and other counties.

SHERBROOKE & QUEBEC.—Application has been made by F. N. McCrea and E. W. Tobin, Sherbrooke, Quebec, to incorporate this company to build a line from Sherbrooke, Que., to the Quebec bridge, 110 miles.

SIERRA MADRE & PACIFIC.—See Rio Grande, Sierra Madre & Pacific.

SONORA RAILWAY.—See Southern Pacific.

SOUTHERN PACIFIC.—This company now has at work about 5,000 men on the extension of the Sonora Railway, south along the Pacific coast from Guaymas, state of Sonora, to Mazatlan and Guadalajara, state of Jalisco, 775 miles. The road will soon be in operation for about 300 miles from Guaymas southeast. The most difficult part of the work is from Guadalajara across the Sierra Madres to Mazatlan. (Sept. 14, p. 69.)

An agreement has been made between this company and the Atchison, Topeka & Santa Fe to build the Northwestern Pacific to connect the California North-Western of the Southern Pacific at Wil-

lits, Cal., with the San Francisco & Northwestern, a lumber road in the north owned by the Santa Fe. This will make a through line from Eureka to Willits to San Francisco, 290 miles. The joint line is to be controlled in alternate years by the Southern Pacific and the Santa Fe. (Sept. 21, p. 76.)

Vandalia.—This company is now extending second track from a point two miles west of the Union station at Indianapolis, Ind., to the top of the grade at Ben Davis, 4¼ miles, the work to be completed by June of this year. Second track is being laid by Jones Bros., of Columbus, Ohio, from Knightsville to the East Yard, Terre Haute, Ind., about 14 miles. This work includes building a new line between Brazil and Seelyville, eight miles, to secure better alinement and grades. This work is to be finished about July 1. From Terre Haute a short stretch of second track from the west end of the Wabash river bridge to Macksville, one mile, is being laid.

Virginia & Carolina Coast.—See Norfolk & Southern.

Winnipeg & Lakes (Electric).—An extension of time for one year has been granted this company, which plans to begin work this summer on lines to Lake Manitoba, Lake Winnipeg and Portage la Prairie, all in Manitoba. T. G. Haig, Winnipeg, is the promoter.

Winnipeg & Northwestern.—This company is applying for authority to build a line from Winnipeg, Man., to the Lobstick River in Saskatchewan, with a number of branches. A. T. Drummond, Toronto, is solicitor.

RAILROAD CORPORATION NEWS.

Buffalo & Susquehanna.—This company has completed its line to a connection with the Lake Shore & Michigan Southern and the South Buffalo at Blasdell, N. Y., six miles south of Buffalo, and has arranged with the Erie for trackage rights into Buffalo from a connection with the latter road a few miles south of Blasdell. Through passenger service has begun and freight service will soon be started under this arrangement. It is supposed that the B. & S. will ultimately enter Buffalo over the Lake Shore & Michigan Southern tracks, and will build its own freight terminals in that city.

Gross earnings for the six months ended December 31, 1906, were $896,301, an increase of $115,912; net earnings $323,815, an increase of $32,671.

Chesapeake & Ohio.—Gross earnings for the six months ended December 31, 1906, were $12,583,400, an increase of $719,244; net earnings, $4,729,553, an increase of $4,180.

Chicago, Rock Island & Pacific.—This company has sold to Speyer & Co., New York, $6,500,000 4½ per cent. equipment notes dated February 1, 1907, and maturing in 20 semi-annual installments beginning August 1, 1907. They are secured on equipment costing over $7,400,000.

See Mobile, Jackson & Kansas City.

Chicago, South Bend & Northern Indiana (Electric).—This company, which has acquired the Northern Indiana, has made a mortgage to the Central Trust Company, New York, to secure an issue of $5,000,000, 30-year, 5 per cent. bonds. The authorized capital stock is $7,500,000. (Feb. 1, p. 163.)

Colorado & Southern.—Gross earnings for the six months ended December 31, 1906, were $6,776,265, an increase of $761,813; net earnings $2,058,310, an increase of $125,815.

Cincinnati, New Orleans & Texas Pacific.—Gross earnings for the six months ended December 31, 1906, were $4,319,431, an increase of $286,925; net earnings, $831,386, a decrease of $120,445.

Detroit United (Electric).—Kean, Van Cortlandt & Co., New York, and William Salomon & Co., New York, are offering at 95½ and accrued interest, to net 6⅝ per cent., $2,000,000 three-year, 5 per cent. collateral trust coupon notes due February 15, 1910. These notes are secured by the deposit of $3,624,000 par value of securities, and the notes are a direct obligation of the company.

Erie.—The New York Stock Exchange has listed $12,000,000 4 per cent. convertible 50-year, series B coupon bonds of 1953; of this amount $2,000,000 were issued in 1905 to pay for locomotives, and the remaining $9,015,000 par value in bonds were sold for $8,715,000; of this sum, $5,278,205 was spent for construction, and $1,672,812 for equipment, up to November 30, 1906. The remaining $1,763,982 cash is held in the treasury, as are also $985,000 unsold bonds, which will be issued from time to time as occasion requires.

It is understood that this company will spend $12,000,000 for the electrification of 225 miles of line, mostly suburban roads, but it is stated that because of the condition of the money market this amount will not be borrowed at present.

Gross earnings for the six months ended December 31, 1906, were $27,025,203, an increase of $1,165,213; net earnings, $8,005,168, an increase of $146,479.

See Buffalo & Susquehanna.

Gulf & Ship Island.—Gross earnings for the six months ended December 31, 1906, were $1,182,417, an increase of $187,830. It is interesting to notice that the tendency toward greatly increased operating expenses, so evident on the larger lines, also shows in the earnings of this road, where the cost of operation increased 37 per cent., leaving net earnings of $267,493, a decrease of $57,525.

Louisville & Nashville.—Gross earnings for the six months ended December 31, 1906, were $23,930,446, an increase of $2,847,768; net earnings, $6,635,890, an increase of $401,504.

Minneapolis, St. Paul & Sault Ste. Marie.—Gross earnings for the month of December, 1906, were $920,498, an increase of $5,809. The operating ratio increased from 51 per cent. to 62 per cent., making the net earnings $350,329, a decrease of $94,260. Gross earnings for the six months ended December 31, 1906, were $6,800,537, an increase of $667,869; net earnings, $3,374,903, a decrease of $76,846. The operating ratio during this period rose from 44 per cent. to 50 per cent.

Mobile & Ohio.—Gross earnings for the six months ended December 31, 1906, were $5,102,540, an increase of $588,276; net earnings, $1,629,050, an increase of $139,439.

Mobile, Jackson & Kansas City.—The management of this road has turned over a majority of the capital stock of this company to a voting trust consisting of J. E. Borne, President of the Colonial Trust Company; Alexander McDonald and B. F. Yoakum, Chairman of the Executive Committee of the Chicago, Rock Island & Pacific. It is said that Mr. Yoakum will supervise the operation of the road.

Nashville, Chattanooga & St. Louis.—Gross earnings for the six months ended December 31, 1906, were $5,688,911, an increase of $425,956; net earnings, $1,205,509, a decrease of $43,832.

National of Mexico.—A semi-annual dividend of 1 per cent. on the $32,000,000 4 per cent. first preferred stock has been declared, payable February 11. When the first dividend, 1 per cent., was declared on this stock last July, it was somewhat doubtful as to whether payments would be continued. Gross earnings for the six months ended December 31 were $3,698,330, an increase of $375,642; net earnings, $1,349,918, an increase of $108,398.

New York, Ontario & Western.—Gross earnings for the six months ended December 31, 1906, were $4,292,447, an increase of $268,668; net earnings $1,485,137, an increase of $259,987.

Norfolk & Western.—Gross earnings for the six months ended December 31, 1906, were $15,085,680, an increase of $1,198,803; net earnings, $5,617,371, an increase of $33,044.

Northern Central.—Gross earnings for the year ended December 31, 1906, were $11,632,700, an increase of $1,100,700; net earnings, $2,654,300, an increase of $592,900.

Pennsylvania.—Gross earnings of the Lines East for the year ended December 31, 1906, were $148,239,900, an increase of $14,317,900; net earnings, $46,434,300 an increase of $5,902,700. Gross earnings of the Lines West were $80,493,300, an increase of $8,479,800; net earnings, $21,753,400, an increase of $2,298,000.

Philadelphia, Baltimore & Washington.—Gross earnings for the year ended December 31, 1906, were $15,941,200, an increase of $1,265,000; net earnings, $4,341,300, an increase of $468,000.

Seaboard Air Line.—This company offered, up to February 1, at 90 and accrued interest, to the stockholders and the holders of voting trust certificates about $7,300,000 5 per cent. general mortgage and collateral trust 30-year bonds, being part of a recently authorized issue of $18,000,000, to the extent of 12 per cent. of their respective holdings; of the remainder of this issue, something over $5,000,000 is for refunding purposes. (Jan. 25, p. 130.)

Southern.—Gross earnings for the six months ended December 31, 1906, were $28,316,306, an increase of $1,711,862; net earnings, $7,104,563, a decrease of $912,118.

Southern Pacific.—Gross earnings for the six months ended December 31, 1906, were $61,570,913, an increase of $7,967,734; net earnings, $23,996,446, an increase of $4,883,984.

Union Pacific.—Gross earnings for the six months ended December 31, 1906, were $39,026,250, an increase of $3,209,165; net earnings $18,809,196, an increase of $1,613,352.

West Jersey & Seashore.—Gross earnings for the year ended December 31, 1906, were $5,206,300, an increase of $553,900; net earnings, $1,249,400, a decrease of $14,300.